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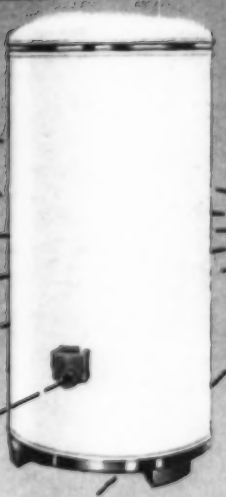

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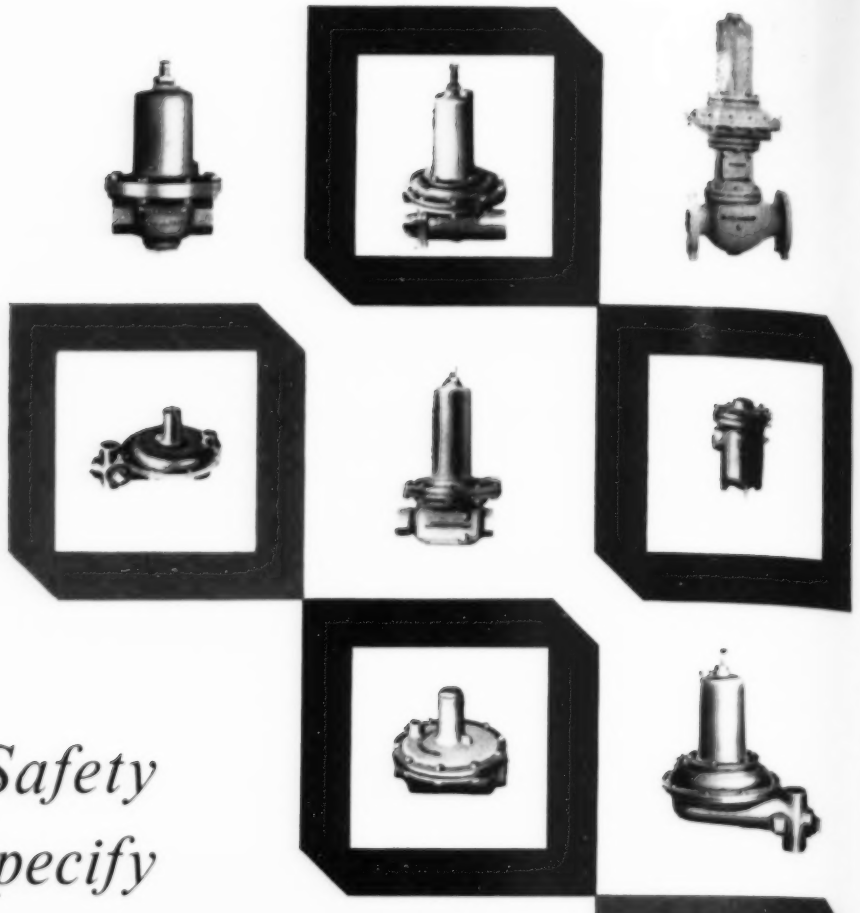

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31ST YEAR OF PUBLICATION

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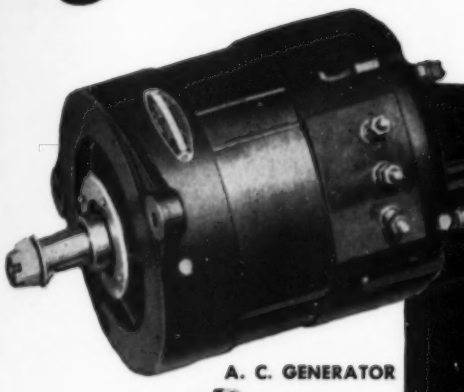

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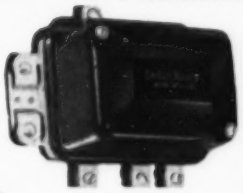

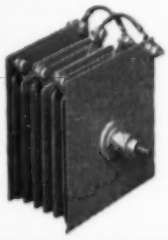

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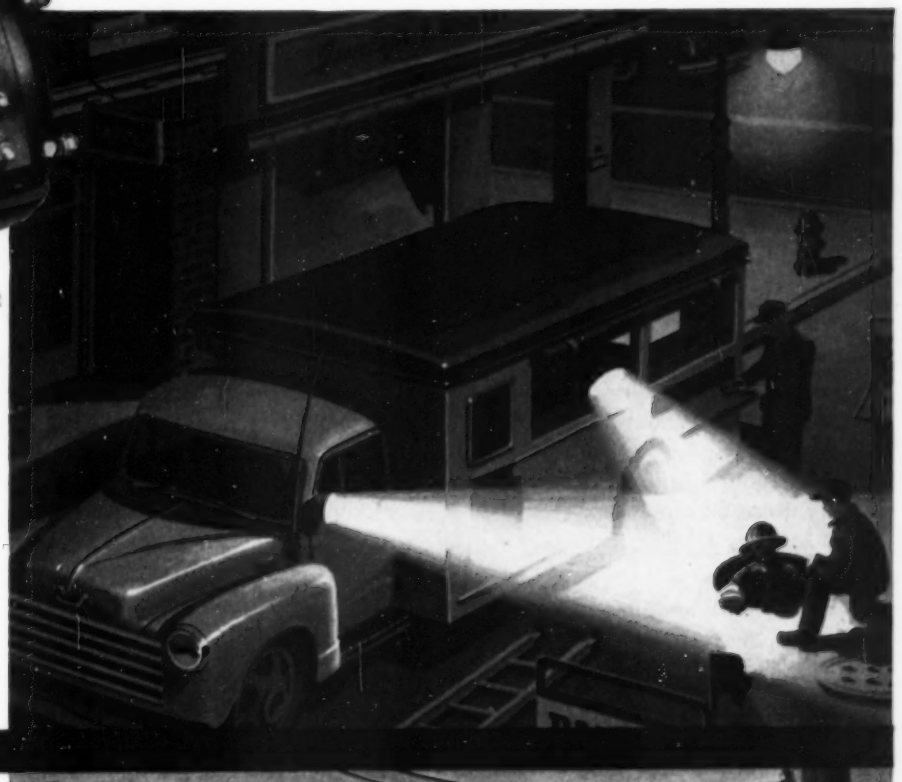

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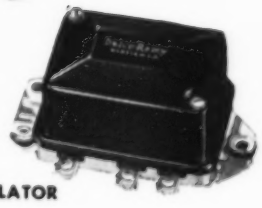

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GAS Thermally Thinking

Waste in government . . . and industry

RECOMMENDATIONS of the Hoover Commission on Organization of the Executive Branch of the Government, embodied in reports now being made to Congress, hold much hope for major reductions in the cost of running the government that, if adopted, might make possible substantial tax savings for both business and the individual. It will be up to Congress to vote them into effect, so quite naturally it would be wise for every taxpayer to make his wishes known to his representative.

The report on Paperwork Management is particularly enlightening in showing up the tremendous waste in governmental operations. The commission reports that no less than $4 billion per year is spent on paperwork alone. The commission found that the government is creating 25 billion pieces of paper annually, not counting periodicals, pamphlets, and similar work, and that the employment of 750,000 federal employees is required thereby. Every working day, about 4 million letters are turned out by government offices—or more than 1 billion per year. Office space for "full-time paperworkers" has an annual rental of $180 million, equivalent to 36 times the capacity of the Empire State building. Record-keeping takes up about $40 million of space per year.

The commission was also highly critical of "government style" letter writing, where one word is never used when two will do the job half as well. The original-and-umpteen-copies habit was also a target for criticism, thus: "A recent study by the Navy of 11 directives indicated that the total number of copies suggested by the originators could be cut from 138,316 to 9326, or more than 93%."

A government-wide paperwork management program that would apply "birth control" to paperwork at its course would bring an initial saving estimated at $250 million.

All along the line in its recent reports, the commission has urged repeatedly that government operations be placed on a businesslike basis. But Part I of the report on paperwork management offers no room for smugness among executives in industry. Apparently, if the government adopted the paperwork practices of certain large corporations, things could actually go from bad to worse. Says the report:

"Paperwork volume in the government, measured for the first time in this manner, tends to confirm the widespread belief that Washington is the mecca of redtape. But many companies measured since the time of the first Hoover Commission found that they had a strikingly similar paperwork volume in proportion to their size. Both industry and government, therefore, produce roughly the same large volume of papers per employee.

"The 25,000 papers and documents piled up for each Federal employee compare favorably with 64,000, 56,000, and 34,000, respectively, in typical companies varying in size and type of industry. One of the 10 largest companies advertised in October 1954 that if all its products now in use were placed one in front of the other they would stretch around the world 1½ times. The official inventory of this company's files also shows that if its business papers were set end to end they would reach around the world twice."

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WILLIAM W. CLARK
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highlights

GAS SPOT NEWS, TRENDS, COMMENT ON GAS INDUSTRY AFFAIRS

Gas reserves are barely "holding their own"

The latest reserves report of the AGA and API committees (see page 166) shows a disheartening small increase for 1954 over 1953. Overoptimism in the two previous years, particularly in the Utah report, is evident in the "extensions and revisions" estimates. But at least one leading geologist (A. I. Levorsen of Tulsa) thinks there are still "about as many possible oil and gas provinces in sight" in the U. S. and Canada as there ever were. Future important discoveries will depend on unorthodox rather than scientific opinions about where to drill, he told an API meeting in New Orleans. He sees the Great Plains region as a likely area for exploration. And Ira H. Cram, senior vice president of Continental Oil, Houston, predicted that within five years offshore drilling will develop a reserve of importance to the nation—if drilling costs are slashed, discovery allowables are granted, and higher allowables are permitted at greater depths.

PG&E signs up for another 100 million

A letter of intent has been signed by the San Francisco utility to boost its purchases from El Paso Natural from 700 to 800 MMcf per day. But the added volumes would be transported in loop lines, not off the proposed Pacific Northwest line to Canada. Pacific Gas is still "investigating the possibility" of importaing gas from Canada, but as yet no commitments have been made.

New domestic air conditioning devices make bow

Two new gas engine-driven compressor-type air conditioners were unveiled in March. Both manufacturers claim considerable cost savings over competitive types of equipment. One says its unit can produce 1 ton of air conditioning for 1 hp. Meanwhile, gasmen have urged at least one manufacturer of turbine-driven equipment for aircraft to investigate the possibilities of adapting its production models for use in domestic all-year gas air conditioning (see page 82).

Hearings starting on bills to free producers

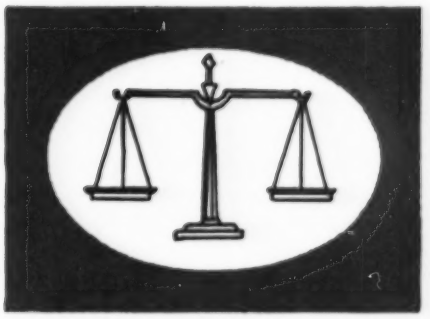
At presstime, House commerce committee hearings were set to start on the numerous bills to amend the Natural Gas Act. Chances of passage appeared to be brightening, particularly for the Harris-Hinshaw bills. The President's cabinet committee report, which favored freeing producers from FPC jurisdiction, was a real boost (see page 154). Majority Democrats seem to have some solid Republican support lined up on the side of the producers. FPC could well rejoice at the prospect. As of Feb. 23 it had completed the processing of approximately 10,000 rate filings by producers, all submitted since June 7, 1954. Hereafter, the commission expects to dispose of rate filings within the 30-day notice period as prescribed. The commission, as of Feb. 23, had also received 5700 applications for certificates authorizing sales of natural gas by independent producers to pipeline companies, and had disposed of 550.

Pacific Northwest back in the news

An SEC decision on Pacific Northwest Pipeline Corp.'s $163 million pipeline financing plan is expected momentarily. An amended filing was made March 9 following an initial filing in February. Pacific says it will go ahead with construction of the line even if the Westcoast application is denied by FPC, but is asking authority to issue an extra 280,000 shares of common in case the Westcoast line is okayed. Contracts have been let to Kaiser Steel and Consolidated Western for 90% of the pipe requirements; aerial surveys and mapping are practically complete; construction is ready to start "any time" with completion of the initial pipeline system set for the summer of 1956. Pacific says it would pay Westcoast 22¼ cents for gas at the border, beginning Nov. 1, 1957, and 22 cents after Jan. 1, 1959. Meanwhile, Westcoast has applied to the conservation board for an increase in exports from Alberta from 42 billion ft per year, currently authorized, to 56 billion over a 22-year period. Balance of the requirements, about 70 billion per year, would come from British Columbia.

*regulatory and legislative trends

Depreciation is delirious again



THIS long period of inflation, during which the loss in the purchasing power of the dollar has become aggravated, has caused the renewal of the controversy over utility depreciation as an operating expense. The torrid dispute is whether the amount of annual depreciation expense, which must be paid by the customers, should be adequate to reimburse the utility for the original cost of the facilities used over their service life, or their economic value. This question is important, because if depreciation is based on value the annual depreciation expense in utilities' financial reports and allowed in rate cases must be increased by millions of dollars during current high prices with the corollary of decreased amounts if prices decline.

Price level increase

The general price level increased about 115% from 1940 to the middle of 1954. Some proponents of economic or value depreciation contend that depreciation expense related to property installed before the great price increase should be higher by 115%. In the gas industry, for example, that would require customer rate increases today totaling $118 million to offset current value depreciation alone. If such an additional allowance is necessary to maintain gas companies in a healthy financial condition, which is required to render good service, it should be made. If the increased depreciation expense is not necessary the regulatory commissions will reject it. Nearly all commissions presently favor original cost depreciation expense. Now is the time for management to decide which side of the issue is better for the long-range future, so that any needed concerted action can be taken to enlighten the utility commissions.

The magnitude of this subject is manifest from the fact that the gas industry had recorded about $12 billion in utility plant accounts at the end of 1953, with reserves for depreciation and depletion totaling $2½ billion, which indicates that provision has been made for about 21% existing depreciation related to the book cost of property.

Let us review the different depreciation concepts, which should assist management in appraising the merits of each one.

The main argument for the value concept of depreciation is that owners of utility property must be allowed to recover the cost of replacing facilities through depreciation charges or the impairment of invested capital will result. Advocates of economic or value depreciation consider it a means to finance replacements. If customers pay for such depreciation the service capacity of the physical property will be maintained without additional investment by the owners.

The proponents of the cost basis of computing annual depreciation expense claim that the logical purpose of the depreciation allowance, in establishing utility prices for service, is to reimburse the owners for the original cost of the utilized facilities by the time the property is retired. This maintains the integrity of the investment; it prevents a loss, but does not assure a profit. The spokesmen add that new high cost facilities enter the depreciable property base with their group life expectancy and at their concurrent cost, and are reflected in the future annual allowance for depreciation.

The proponents of the cost basis emphasize the cost of doing business, not the financing of property replacements by the depreciation allowance. They assert that the cost of a compressor plant becomes just as much a part of the cost of rendering gas service as the cost of the fuel consumed in operating the compressor plant. The cost of plant under this view can be considered a prepayment of the cost of future services; and as the utility services are realized, depreciation is recorded as a cost of service. As the economic life of the compressor plant is used up in transporting gas, the dollar cost of the compressor plant is charged gradually as a cost of operations. The fact that in future years, a new compressor plant may cost more dollars does not change the cost of service rendered by the old compressor plant.

Value depreciation

The advocates of value depreciation differ on whether depreciation expense should be based upon the concurrent level of prices, or upon the estimated cost of future replacements at the time of property retirement. There are difficulties in the gas utility industry, with facilities having a relatively long composite service life, in predicting the distant future price level and anticipating technological improvements in compressors, pipes and equipment. Those difficulties become great only if history repeats itself and this nation experiences wide price fluctuations in the future. The supporters of value depreciation based on future replacement cost will not assume an unreasonable risk if the forecasts of some eminent economists materialize. Those educated men opine that the present plateau of high prices is most likely to be permanent, with minor fluctuations. They reason that (1) the current enlarged money supply will not decline significantly, (2) the unit cost of labor will not decrease, and (3) a depression sufficiently severe to drive the price level down

*A monthly commentary on national and state developments by an expert in the field of utility law.

to approach the pre-World War II level is not probable, politic, desirable, or feasible.

One of the arguments in support of value depreciation is that the common stockholder of the utility does not otherwise receive fair treatment. It is stated that if the common stockholder receives the same nominal dollars in dividends during a period of inflation as he received prior to that period, he has suffered an impairment in purchasing power or real dollars. The allowance of economic depreciation is intended to help compensate for this. In answer to this, the opponents say that if common stockholders of utilities were granted protection against inflation through value depreciation allowances, the common stock of utilities would become so attractive to investors that the yield on common stock capital would decline. Then the consequence of the investors' appraisal, and their acceptance of a lower rate of earnings on such common stock money would mean lower commission allowed rates of return to utilities, which are generally guided by the cost of money.

Economic depreciation

A new argument has been presented recently in favor of economic depreciation. It is stated that inventories and depreciation expenses should be based upon the cost of plant as adjusted by a general price index. The Wholesale Commodity or Consumers Price Index from the Bureau of Labor Statistics is considered adequate. The advocates of this current price level accounting state that it has three attributes: (1) it does not require a distinct departure from basic accounting principles; (2) it can be consistently and objectively applied to basic accounting data; and (3) it is not a replacement cost theory, the accounts being adjusted for changes in the value of the dollar and not for changes in the cost of specific property. For illustration, if the price level today is 50% higher than when the particular property was acquired, then today's depreciation expense would be based upon cost but increased by 50%.

The reason given for this novel proposal was to solve the problem of stating earnings of corporations in comparable dollars after matching costs with sales dollars. There is a difference between the value of the dollars paid for plant at various dates and the value and revenue dollars. When prices advance rapidly business costs are understated and income is overstated. One of the areas most affected by price changes under present accounting practices is the depreciation charge, declare these advocates. The report of the Machinery and Allied Products Institute indicated that corporate profits were overstated in 1946-50, and that $12 billion of the overstatement represents the failure to charge adequate depreciation expense. Depreciation charges should be expressed in terms of the current dollar rather than original cost of the property in order to report real earnings, according to the example given by the Business Executives' Research Council of Greater Chicago. Assume the original cost in 1940 for a gas compressor was $100,000, and that the price level increased 100% by 1954; so the current cost is $200,000 to maintain the equivalent investment and capacity in a compressor. The compressor has a 20-year service life, and one-twentieth was used up during 1954 with the annual depreciation expense being $5000 based on the 1940 original cost. Assume 1954 sales revenues were $100,000 and after deducting all expenses, including $5000 for depreciation, the profit was $20,000. The supporters of this concept declare that this profit figure is not correct, because the depreciation charge only reflects the value of the assets in the compressor in 1940 dollars. In terms of 1954 dollars, the depreciation charge for one-twentieth of the fixed asset should be $10,000, or one-twentieth of a $200,000 compressor.

Same shortcomings

The answer given to this current dollar depreciation proposal by opponents has been that the plan contains the same shortcomings as the replacement cost theory, because it makes no allowance for technological improvements in future facilities which will replace existing utility property. Another cautionary view is that in a period of high prices the fixing of depreciation charges in terms of current dollars will provide more money to the corporations from the rate payers, but in a period of declining prices the method could be extremely harmful to the industry.

During this debate some persons have contended that value depreciation is required by law. The United States Supreme Court has ruled that depreciation methods are permissive and within the expertise of regulatory commissions, and has refused to prescribe any single formula. In 1944, in the celebrated *Hope Natural Gas Co.* case, the Supreme Court rejected the contention that depreciation expenses must be based exclusively upon the present fair value of the utility property.

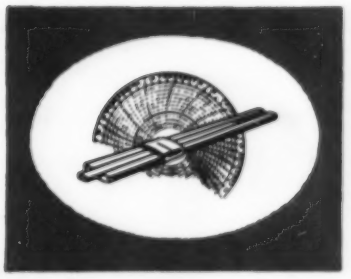
In considering the question of whether depreciation expense should be based upon the cost or the value of property, it is well to remember that the cost basis is prescribed by all the Uniform Systems of Accounts required by regulatory commissions in the United States. It is also the basis used by a majority of non-regulated businesses, even though recently certain large corporations, like the steel companies, adjusted depreciation expenses to include an allowance for increases in the price level.

Depreciation hedge

The defenders of the cost basis for computing depreciation have declared that utilities possess a depreciation hedge. They state that utilities, unlike many of the non-regulated industries, have rate protection during economic cycles of high prices and low prices. In the competitive non-regulated industries, it is asserted, there is no assurance that the cost of plant installed during periods of high prices will be covered by future revenues. The forces of competition can be inflexible in a buyer's market. Regulated utilities have been permitted to recover depreciation expense, based on original cost of facilities, in times when prices of facilities are high. Certain supporters of the cost depreciation basis, who comprise the National Association of Railroad and Utilities Commissioners' depreciation committee, conclude with this admonition:

"Public utility regulatory commissions, in fact, have always been in the forefront of those insisting on stating depreciation on a cost basis, regardless of whether plant costs were incurred in times of low or in times of high prices. This assurance which utilities have that their legitimate costs will be recognized for depreciation purposes is a highly significant protection against the dangers of price changes which they should thoughtfully consider before insisting upon assuming the risks associated with the variable allowances they would receive under the value concept." ■

technical trends



• By GUY CORFIELD

"A slight trace"

A chemical analysis report will often indicate a "trace" or a "slight trace" of some component, meaning a very small amount which it may not even be possible to define in exact concentration, or which the chemist knows is there and understands is unimportant numerically but should be mentioned rather than omitted or stated to be "not present." Again, however, these "traces" may represent components that were not previously known to be present because of inability to determine them at all, at least with any degree of certainty or precision, with then known analytical methods. Micro-analytical methods are now improving rapidly under the urge of realization of the importance of trace constituents such as vitamins in foods, elements in animal and vegetable nutrition, and metals in alloys.

In our gas industry, an important "trace" is the odorant added to natural gas, and we are still not able to analyze for it with precision; sulfur, particularly hydrogen sulfide, in amounts almost beyond our ability to detect analytically, are being looked upon with suspicion by corrosion engineers; and, most recently, the trace constituents of "perfect" combustion of gas, i.e., oxides of nitrogen, aldehydes, ketones, acids (such as acetic acid) and "organics" (unburned or partially burned hydrocarbons) are coming to the attention of those concerned with air pollution control.

"Petroleum microbiology"

In his book, which carries that title, Ernest Beerstecher Jr., associate professor of biochemistry, University of Texas, says in his preface that "One of the most difficult infants of the oil industry has resulted from the marriage of petroleum engineering and bacteriology. New and strange terms have been invented which clothe the child and confuse the parents—biogeochemistry, microbiological exploration, and petroleum microbiogenesis. The unfortunate result is that both engineers and bacteriologists now view this field with some misgiving."

He further states, in a summary of one of the chapters, that "microorganisms have had a considerable influence in shaping the present status of the earth's surface geological formations. In the case of igneous rocks, their effect has largely been one of helping in the erosive processes which continually modify the rocks and provide the raw material for sedimentary deposits. Of the sedimentary deposits, there is hardly one that is not linked in some manner with the agency of the microbes. . . . They are effective in the formation and dissolution of sedimentary sulfur deposits, and in the overall sulfur, carbon and nitrogen economy of the earth's surface. They play an important role in all moist soils, and in the accumulation of coal and petroleum deposits. Microbial biochemistry is therefore an important portion of the science of geology, and of vast pertinence to the fields of petroleum geochemistry and engineering."

While this may sound somewhat beyond the interests of the gas business, the possibility appears that this microbial activity is a very direct and close influence in the past and future production of oil and natural gas, and can well merit study in relation to certain phases of gas discovery, production and storage. The book associates microorganisms with the synthesis of petroleum, exploration for its occurrence, and modification of its constituents. It is hinted that microbes are responsible for the occurrence of sulfides in natural gas, by reducing sulfates and evolving hydrogen sulfide; and that their activity might have a considerable long-term influence on the porous structure of an underground gas storage reservoir because of formation of deposits that may plug the sands, particularly if such reservoir did not formerly contain hydrocarbons. Mention is made of exploration for underground petroleum by analyzing for traces of waxy gas-bacteria interaction products on the ground surface.

Bacterial corrosion of buried pipelines—a subject with which the gas industry is relative familiar—is also discussed and attributed to the same action as mentioned above, whereby the microbes utilize sulfates and produce hydrogen sulfide, which attacks the pipe. It is stated that this bacterial activity is suppressed if the soil pH is above 9.5 or below 5.5, or if cathodic protection is adequately applied.

Magnesium

Light, strong magnesium, the principal producer of which is Dow Chemical Co., is apparently due for a considerable increase in output and usefulness, the expected production of primary ingot being 95,000 tons in 1955. There is not much danger of the supply running out as it has been estimated that it can be produced from sea water (a present principal source) at the rate of 100 million tons per year for a million years with reduction of the magnesium content of the sea by only a fraction of a percent; it is also produced from salt brine in Michigan, and from the mineral dolomite.

It can now be obtained as plate, sheet, extrusions and castings. The largest tonnage, 33%, is used by the aircraft industry; the aluminum industry consumes 20%, for alloying purposes; machinery and tools take 10%; cast anodes, used for cathodic protection, currently account for 5%, but it is estimated that this figure will increase to 17% within the next 5 to 10 years; and ground transportation absorbs about 4%. There is also the expectation that it will invade new fields such as household appliances, business machines and textile machinery.

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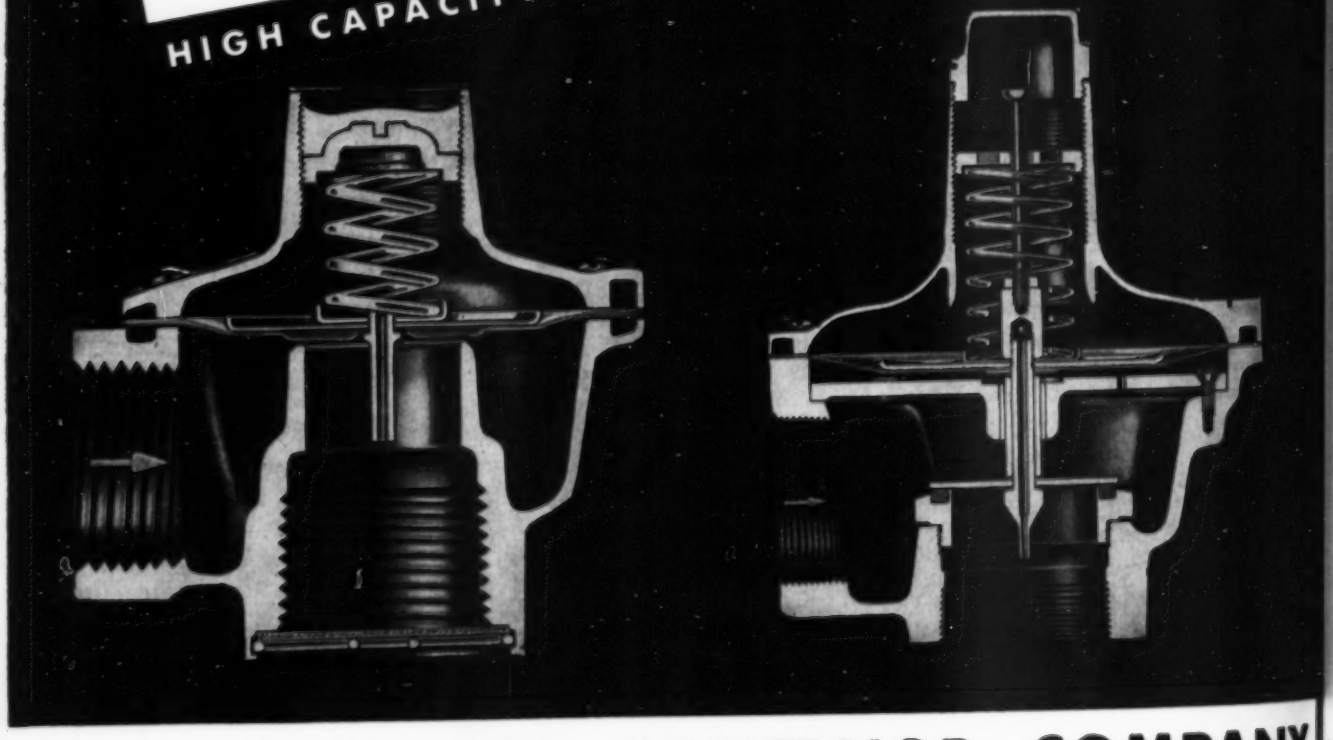

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DISTRIBUTION MAINTENANCE ISSUE

GAS

APRIL 1955

MAINTENANCE IS GOOD BUSINESS

During the peak-load winter months, operating and engineering personnel of gas distribution companies start basic planning and budget estimates for the formation of the following summer's maintenance program. Leakage reports are studied, leakage locations and frequencies are graphically represented, and unaccounted-for gas curves and data assume a stature of new importance. Unfortunately, corrective and preventive maintenance fall into a non-revenue classification that generally limits the maintenance program to the areas of necessity, and the routine needs may be skimmed over or ignored. This may be good business, but even the more conservative elements of the gas industry raise doubts about good business in relation to partial maintenance.

As of Jan. 1, 1955, the gas industry will have a creature of its own creation to live in harmony with—this is the AGA-, ASA-, and ASME-approved revision of Section 8, ASA B31.1, Code for Pressure Piping. Section 8 is devoted to gas transmission and distribution piping, and contains a chapter that covers operating and maintenance procedures affecting the safety of gas transmission and distribution systems. This is a new factor that may influence the determination of the extent of maintenance operations.

The wording of the code requires the reader to lean heavily on his own and others' interpretation as he peruses the provisions of those parts of the literature dealing with distribution system maintenance. However, as indefinite as the contexture is, the responsibility is there—it has been placed there by the gas industry's own representatives. Personnel of Subcommittee No. 8 obviously felt that the maintenance provisions were good business for the gas industry; it follows that what is good business for the gas industry, is good business for an individual distribution company.

Logically, then—*maintenance is good business.*

Articles follow on how to maintain general distribution systems, mixed gas plants, manufactured gas plants, and mobile radio equipment.

Good maintenance programs call for pressure maintenance work as well as physical improvement of facility conditions. Here, distribution pressure is being checked following installation of new regulators in a vault-contained district regulator station.

Distribution maintenance—1955

By J. FRED EBDON • Managing Editor

MAINTENANCE has always been good business from the point of view of gas distribution companies, but this year there is the impact of approved revision of Section 8, Gas Transmission and Distribution Piping Systems, of the Code for Pressure Piping, ASA B31.1, to be considered. The code is nothing new, but the nationwide interest in and awareness of its implications are certainly new. Just how far the effect of the revised Section 8 will be carried cannot be determined as yet; however, it is logical to expect that sooner or later it will be brought into the courts, as evidence either for the prosecution or the defense. We suspect that the company that finds itself able to say before any court that it has complied with the code, which is nationally recognized as setting forth general requirements for safe operations, will have "something to hang its hat on."

In addition to the maintenance work provided for in the code, each operating company will have more formal maintenance work that has developed into a planned maintenance program based on its experience through the years. These are the real maintenance operations that provide for long-range economies in a system's operation and provide the reasonable safety that a distribution company's customers have grown to expect. Many companies will have no need for the maintenance specifications of the code as they have been well covered for years in routine procedures, but the code can serve as a focal point or backbone for even these companies. The philosophy of the code relative to maintenance is clear; it cannot and does not try to prescribe a set of maintenance procedures that will guard the public safety under any and all situations and contingencies, but rather depends upon the individual companies to rely on their operating experience, knowledge of their system and equipment, and knowledge of their operating conditions to formulate a definite maintenance program based on the code's provisions.

To comply with the code, each distribution company should have a plan covering code-based maintenance procedures. This plan should be followed, records should be maintained to show compliance with the plan, and the plan should be modified as operating conditions change. Specifically, the plan itself should include:

(1) Detailed instructions for maintence procedures during periods of normal operation, repairs, and emergencies.

(2) Particular attention to those portions of the facility that require extra-

GAS staff report

ordinary maintenance because of hazardous location or dependency.

THE MAINTENANCE BUDGET

During the winter months when the demands on distribution systems and the men who operate them are at a peak, the maintenance budget is put in final shape. The two factors that are most heavily weighed in maintenance budget formation are (1) leakage reports and records, and (2) unaccounted-for gas data. Obviously, when these data reach excessive values, there is an immediate need for maintenance in the form of repair or replacement.

Other factors that most companies will consider when preparing the maintenance budget are, in part:

(1) *Backlog of main replacements:* A company is likely to have a build-up of main replacement projects that have been set aside during the period of peak demand because construction might reduce or interrupt system delivery capacity.

(2) *Increased wage and material cost:* These, as everyone knows, have been on the increase for the past 15 years and certainly affect the amount of money that has to be budgeted each year. Most companies would prefer to budget a very similar amount of money for maintenance each year, but this is one factor that influences a steady increase in yearly maintenance costs.

(3) *Age of the system and subsequent increase in the number of connected customers:* As the system grows older it is logical to expect that the maintenance costs will increase as signs of deterioration, faulty materials, poor workmanship, or damage become evident. Also, the steady increase in customers that most gas companies have experienced increases the over-all outlay for maintenance. At the unit level, the maintenance cost is generally reduced by an increase in consumers, but the total is increased.

(4) *Relocations and/or improvements in advance of municipal, county, or state improvements:* The factor has become of increasing importance in the last few years in many areas. If there are maintenance works that have been held in abeyance awaiting the propitious moment, it is logical to proceed with them at the time relocations or improvements have to be made as public developments and improvements demand.

As a matter of policy, most gas companies try to prevent drastic fluctuations in the maintenance budgets from year to year, but as the amount varies more or less with the need, this is not always possible. Of course, one of the prime factors in the determination of the money that will be spent for maintenance work is the revenue from the previous year. Most gas companies have an ideal maintenance budget that is based on the determined need, and a practical budget that is based on the relationship between funds available and the importance of various projects. It may work out that some needed work has to be set aside until funds are available to accomplish the more critical work along with the less important maintenance.

The code will probably have a marked influence on the total amount of maintenance money that will be spent by gas distributors; however, it will have an even greater effect on the allocation of the maintenance money. For instance, there is likely to be more rebuilding of town border and district regulator stations in 1955 to add pressure relief capacity and other pressure limiting devices than was the case in former years. Also, there will be more money spent on leakage surveys and reduction, and in revamping lines for higher pressure under the procedures for this operation as outlined in the code.

It is interesting to note that some distribution companies have indicated that the newly approved revision of Section 8, ASA B31.1 will mean that several hundred-thousands of dollars of additional maintenance money will ultimately be spent to reconstruct facilities; however, others have reported they will spend nothing additional for this objective as they feel that they have been and are in conformance with the code.

PIPING MAINTENANCE

The code requires each distribution system operating company to set up a plan for making periodic leakage surveys. From the code, the following types of surveys may be used singly or in combinations:

(1) Gas detector surveys.
(2) Bar test surveys.
(3) Vegetation surveys.
(4) Pressure drop surveys.

Distribution network problems

A NEW procedure for solving gas distribution system network problems has been outlined in a paper by Dr. Jack Warga, senior mathematician, ElectroData Corp., Pasadena, Calif. The new procedure, which is actually two methods that may be used separately or in combination, is offered by Dr. Warga as a substitute for the widely used Hardy Cross method as well as for the procedures applied in conjunction with a linear network computer, both of which, he argues, fail to converge to a solution.

The first of Dr. Warga's two methods is apparently new and can be shown to converge to the correct solution of the problem under all circumstances. The second method, an application of the Newton-Raphson method, will converge to a solution at a very rapid rate, provided certain conditions are satisfied. Either procedure or a combination of both is suitable for use in programming the solution on an electronic digital computer since the characteristics of convergence can be investigated beforehand.

Dr. Warga points out that both the Hardy Cross procedure and the method applied in conjunction with a linear network computer fail to converge either in general or under special conditions. This disadvantage of existing systems, he argues, which becomes especially accentuated when the network under study is of even moderate complexity and the use of high speed digital computers is indicated, makes it essential to consider methods where convergence behavior can be predicted at least to some extent.

Because of the interest in the various methods of distribution system network analysis that has developed within the gas industry over the past few months, due in part to the current series of symposia on this subject that are being sponsored by GAS magazine, we feel that Dr. Warga's discussions should be given widespread distribution. Therefore, as a special service to those in the gas industry who are particularly interested in this subject, GAS magazine is making available to all who request it a complete draft of Dr. Warga's discussion. Copies may be had by writing GAS, Dept. C, 198 S. Alvarado St., Los Angeles 57.

In addition, because of the discussions on the various methods of solving distribution system network problems that are to take place during the annual AGA distribution, motor vehicle, and corrosion conference in Cincinnati in mid-April, copies of the discussion will be available for distribution with GAS magazine at this meeting.

Maintenance—1955...
The type and scope of the leakage control program are left up to the company

(5) Soapsuds testing on exposed pipe and fittings.

(6) Some other effective procedure for locating leaks in underground piping systems.

The type and scope of the leakage control program are left to the discretion of the operating company, based on their local conditions and operating techniques, but the responsibility is clearly implied. The character of the service area and the housing or building concentration should determine the frequency of the inspection program. Further, the code makes the following recommendations:

(1) Business districts should be surveyed for leaks with gas detectors at least once a year.

(2) Other parts of the distribution system should be surveyed with one of the previously listed methods as often as experience indicates is necessary, but at least once every five years.

(3) When surveys indicate the existence of leaks, the operating company should investigate them promptly and make necessary repairs.

(4) When mains or services are determined to be in such poor condition that they should not be retained in service, they should be replaced or reconditioned.

These provisions do not appear to urge any serious revamping of gas company operations. They are very basic safety philosophy that has probably been established policy for years in most companies. Many companies have their own standards for gas detector surveys in business districts that usually specify a frequency in excess of that provision in the code, i.e., on an average, gas companies over the nation make this type of survey in business districts at least twice a year. Other particularly sensitive areas or buildings may be tested and/or surveyed frequently. For instance, schools and institutions are usually surveyed for leakage once or even twice a year, while routes of parades, foreign dignitaries, etc., are surveyed just before the event.

Other survey methods are being used in other parts of distribution systems in excess—again—of the recommendations of the code. Some companies use one or two methods, while others use several survey methods and correlate the results in a general leakage survey.

Leakage survey methods

Gas distribution companies have indicated that they use the following methods for surveying for leakage. The survey methods are listed in order from the most used to the least used:

(1) *Bar-testing mains and services:* This is done by driving a drive bar or probe bar into areas of suspected or indicated leakages that are usually located by other methods. After the pipe is located with a pipe locator or from physical measurements, holes are sunk with the bar and the presence of leakage is checked by smelling, gas detectors, or lighting off the hole. The latter is not particularly recommended, but it is done under certain conditions. This physical probing can be the most expensive method for locating leakage; however, it is a method that must be used under certain conditions with some of the other methods, and it must be used exclusively in some locations.

(2) *Gas detector surveys:* This survey method involves applying the sampling attachment of a gas detector or combustible gas indicator to street openings such as manholes, catch basins, valve pits, regulator station vaults, pavement cracks, sidewalk cracks, and at any other openings that might allow leaking gas to be detected in the atmosphere thereof. This should include all such openings for attachments to gas, water, electric, telephone, telegraph, steam, and even sewer facilities underground, although, in some instances, the results may be of questionable value. Specifically, the results from testing sanitary sewer manholes may produce a variety of results as some of the gases therein will give readings on some instruments that would indicate gas leakage when actually this might not be the case. Also, gasoline or other hydrocarbons at manholes will give an indication of natural gas leakage on some instruments unless selective elements are used when the sampling is made. It might be difficult to determine, under certain of these conditions, if a distribution company's product gas is giving the leakage indication or if the indication is the result of gasoline leakage or spillage from a corner filling station. In general, this method is one of the best and least expensive of the survey methods.

(3) *Vegetation surveys:* This method is usually combined with patrolling and is a very efficient leakage detection method. Some companies use the crews of professional survey service companies, while others have their own crews that they feel are adequately trained to perform this operation. Basically, areas exhibiting dead or damaged vegetation are bar-tested, or tested by other methods, for the presence of escaping gas.

(4) *Patrolling lines with heavy odorization or a combination of heavy odorization and increased pressure:* Many large leaks, and some reasonably small ones, can be efficiently located on a first-search basis by temporarily increasing the concentration of malodorant used to odorize the gas. If service regulators are used on the customers' installations in the system or section of the system under test, the effect of the survey can be greatly increased by raising the pressure in the system to a temporary value that is in excess of the pressure carried during winter operations.

(5) *Pressure drop surveys:* In this method, the plotted relationship between pressure and rate of pressure drop

COMING...next month

Just as the editorial emphasis in this issue has been on maintenance within the operating scope of the distributing utility, so will the emphasis of the May issue be on maintenance problems and techniques; but in that issue, attention will be given to the biggest single field of maintenance in the transmission side of the business—compressors and compressor stations.

May is traditionally a month when pipeline problems are thrust to the forefront, with the AGA holding its annual transmission conference. It's also the traditional month for the GAS annual report of construction budgets, and the maps that record current progress on major pipeline expansions.

are used. The system under survey is isolated by shutting off the supply for a short period and computing the volumetric equivalent of the measured pressure loss during the interval. The curve plotted for a system that has no leakage will show a constant rate of pressure drop while a system with leakage will produce a curve that shows a change in rate of pressure drop that is directly proportional to the effective pressure on the system.

(6) Other effective methods: For locating leakage, such as walking high-pressure lines during and after substantial rains, "dead-hour" input tests, customer complaints, cellar inspections, and observations by the meter-reading forces.

Gas companies have long recognized the economy and relief from public liability that result from a planned leakage reduction program that is in force over a period of years. Leakage reduction is a problem that can be approached on a year-around basis, with company forces, and can be given special attention during slack periods. Some companies have had excellent results from hiring college students or young high school graduates during the summer months for special leakage reduction programs.

Patrolling

The code makes special provisions for the periodic patrolling of distribution mains that are installed in locations or on structures where abnormal physical movement or abnormal external loading could cause failure or leakage. The frequency of the patrolling should be determined from the severity of the conditions and the subsequent hazards to the public safety.

Abandoning inactive mains and services

When excessive leakage, or any other condition, requires the abandonment of a main or service, the code provides that the pipe be capped, plugged, or otherwise effectively sealed at both ends if the piping is physically separated from the source of gas supply. If service lines are abandoned without removal from a live main, both ends must be sealed or effectively closed by some means that will eliminate the possibility of gas passing. In the case where a main is abandoned along with the service lines connected to it, the main should be sealed at both ends and the services sealed at the customers' end as previously stipulated.

These provisions are just good operating practice and will certainly not cause any hardship to distribution operators.

MAINTENANCE OF PRESSURE

The code specifies that all pressure limiting and pressure regulating stations and equipment shall receive planned periodic inspections and/or tests to assure that they are adequate from the design point of view, and to determine that they remain in operating condition during their service life. The periodic visits to the stations should ascertain that the primary and associated equipment are in good mechanical condition, have the capacity and reliability to do their designed tasks, are set to operate at the proper pressure, and are installed so that proper operations are assured.

Relief valves are singled out for testing in place whenever such a practice is practical. The test specified is one that will prove that the valve(s) have ample capacity to limit the pressure to the desired maximum value in the system or facilities being protected. In the case where physical testing of the relief valves is not practical, the code states that the required capacity of the protective valves at each station should be calculated periodically and the results compared with the rated or experimentally determined relieving capacity of the installed devices. These calculations must give full consideration to the working conditions as installed. If the tests or calculations reveal that the relief capacity installed is insufficient, the proper capacity must be met by the installation of new or additional capacity.

Although the wording of the code leaves an area for interpretation, the implications of the foregoing are pretty obvious. However, most companies do maintain their pressure regulating, relief, or limiting devices and their installations through the medium of periodic visits and tests. A complete inspection and cleaning at regular stations is usually done on a semi-annual schedule or, at least, on an annual basis. There may be some trouble experienced, however, in complying with the code's version of adequate capacity for pressure-relief devices. This may be particularly critical in the case of low-pressure distribution system regulator stations. Several companies have reported that they will spend considerable money in rebuilding regulator stations and installing additional relief capacity or other pressure-limiting devices to prevent pressure build-ups to values in excess of the maximum permissible values as determined by applicable portions in the code. In fact, it will take a detailed engineering study for any company to determine that it is in compliance with the code on pressure-relief capacity or other pressure-limiting facilities.

VALVE MAINTENANCE

In essense, the code specifies that distribution system valves that are necessary for the safe operation of a system must be maintained in "quick" operating condition. This could and should include periodic lubrication and inspection for alignment to enable valve keys and wrenches to be readily used. The periodic inspection should also include a check to insure that valve boxes or stacks are free of foreign material that might make operation of the valve difficult or impossible.

VAULT MAINTENANCE

If a vault contains a volume of 200 cu ft or greater, the code provides for a periodic inspection of it. This should include:

(1) Determination of a good physical condition.

(2) Checking for adequate venting capacity and the determination that the venting system is clear and functioning properly.

(3) A test of the atmosphere inside the vault for a combustible gas mixture.

(4) A check and elimination program for leakage within the vault.

(5) A check of the vault covers to make sure that they align and do not in any way present a hazard to public safety.

• • •

The code will develop in scope and coverage as interpretations are made through the channels set up for this purpose. At present, it probably implies more than it actually states; however, the distribution companies themselves should be well aware of what maintenance means in the way of increasing the effective longevity of capitalized equipment, protecting the public safety, and relief from public liability. The code will point up these needs and serve as the industry's basic standards for the accomplishment of economy and safety through maintenance. ■

Flow chart of the manufactured gas system from the coal barges to the mains. Points requiring particular attention in any maintenance program are shown in the blue circles. This first of two installments carries the coal through the coke ovens and shaker screens to the point where it is conveyed to the gas producers. (The steps enclosed in parentheses within the blue circles will be covered next month.)

BUCKETS, HOISTING CABLES, HOISTING MACHINERY, CRANE WHEELS, COAL HOPPERS
OIL AND COAL IN BY BARGE AND STEAMER
UNLOADING COAL FROM 11,000 TON STEAMER
CONTROL WIRE, CROSSHEADS, AIR BLAST VALVES, DRIVE SHAFT THRUST BEARING, WATER JACKETS, ROTATING GRATES, PUSHER ARMS, DECK PLATES
COKE AND TAR OUT BY BARGE FOR COMPANY USE OR OUTSIDE SALE
CONVEYOR BELT
COAL AND COKE STORAGE
COAL TO OVENS
LIFTING SHELVES, DEFLECTORS IN BREAKERS, PERFORATED SCREEN PLATES
COAL PULVERIZER
MIXING BINS
SHAKER SCREENS
STORAGE BIN
TRACTION GEAR, REVERSING MACHINES & MOTORS, PUMPS IMPELLERS, COKE GUIDE, CAPS OVEN FLOOR
CORE SCREENS
PRODUCER GAS FOR OVEN HEATING
BOOSTERS FOR AIR TO AND GAS FROM PRODUCERS
RELIEF HOLDER
COOLER
PRODUCER GAS GENERATOR HOUS.
PRODUCER GAS
CENTRIFUGAL & RECIPROCATING PUMPS
WASTE HEAT BOILER, GRATES, AIR BLOWERS, EXHAUSTERS, IMPELLERS, BOILER TUBES, STOKER HOPPERS, FAN HOUSINGS, BOILERS
PRIMARY COOLER
OVEN GAS EXHAUSTER
SECONDARY COOLER
TAR PRECIPITATOR
LIGHT OIL SCRUBBER SATURATOR
FINAL COOLER
AMMONIUM SULPHATE SOLD
SULPHURIC ACID IN
LIGHT OIL SOLD
PURIFIERS
OVEN GAS METER
PLANT HOLDER
EXHAUSTER
WATER COOLERS
METER
NATURAL GAS FROM 24" MAIN
METERS AND REGULATORS
CONTROL HOUSE
METER
PUSHER
GAS TO LOW PRESSURE TRANSFER SYSTEM
METER HOUSE
ROTOR OIL SYSTEM, OVERSPEED TRIP MECHANISM, NOZZLES, BEARINGS, IMPELLERS
PURIFIERS
TAR PRECIPITATOR
LIGHT OIL BOILER
LIGHT OIL SOLD
STEAM TO OTHER PLANT USES
BOILER HOUSE
EXHAUSTER
CONDENSERS
WATER GAS TAR SOLD OR USED FOR BOILER FUEL
STEAM TO WATER GAS GENERATORS
WATER GAS GENERATOR HOUSE
SURGE TANK
RELIEF HOLDER
CARBURETED WATER GAS OR REFORMED NATURAL GAS
ENRICHING OIL TANK
NATURAL GAS FOR REFORMING
OIL TO GENERATORS
WATER
( ) TO BE COVERED IN PART 2

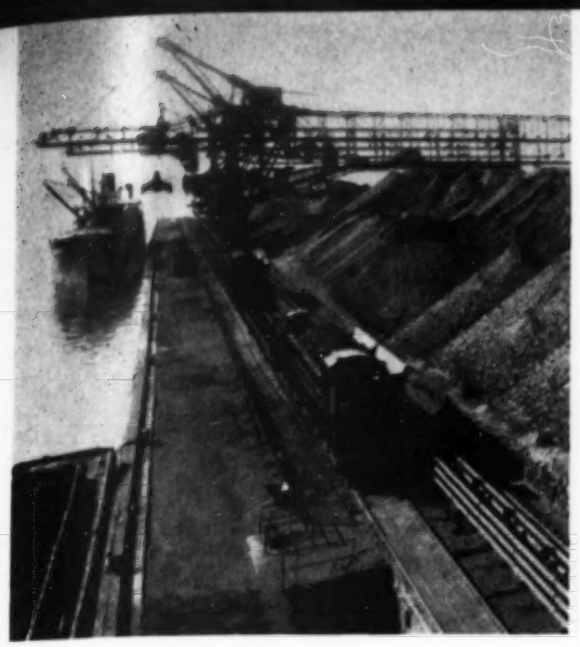


Fig. 1. Buckets and hoisting cables on travelling cranes used to discharge coal deliveries usually deserve more attention than they receive.

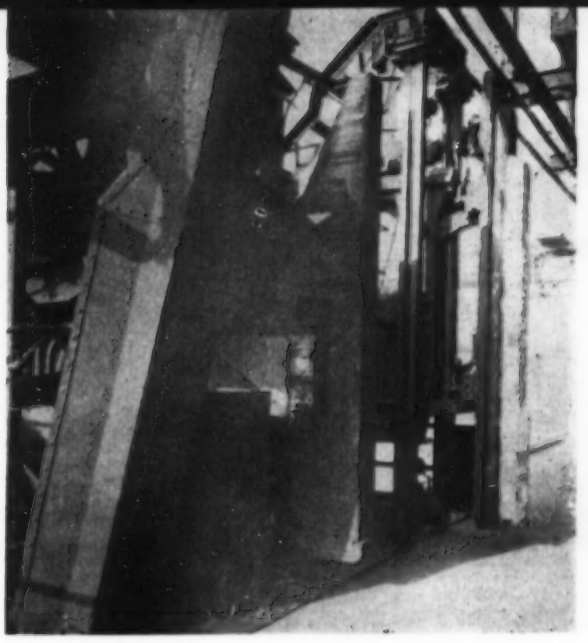


Fig. 2. First equipment exposed to the abrasive action of coke is the heavy duty machinery used to push the coke from the ovens.

Maintenance of check points in a manufactured gas plant

By F. R. WADLEIGH, Superintendent
Hunts Point Plant, Consolidated Edison Co. of New York Inc.

A PLANT located on a waterway will frequently receive its supply of coal in barges or seagoing colliers from which is is discharged by a gantry or some other type of travelling crane *(Fig. 1)*. The buckets and hoisting cables usually deserve more attention than they receive and the bucket lips or nose plates, as they are sometimes called, take considerable abuse. If possible a material should be selected that can be straightened and welded without being removed from the bucket proper.

Hoisting cables should be of the best quality. They are an item of great importance to safety as well as economy. The need for lubrication and careful, regular examination to locate broken wires in the strands cannot be over-emphasized. Gauges are available to measure the wear in the sheave grooves and should be used regularly to prevent the use of worn sheaves, which pinch the cables and thereby reduce the tonnage handled. Methods are also available to determine the approximate remaining life of a cable in percentage of original breaking strength. The life of a cable, other things being equal, varies inversely with the rope speed. Therefore, watch closely a fast-moving hoist. Personnel responsible for the condition of hoisting equipment should be familiar with and use the methods mentioned.

The hoisting machinery proper can be of varied design but will usually be powered by electricity. The service is generally severe and preventive maintenance is a must if hoist motors and their controls are to be operated economically. A recent change on two alternating current cranes using dynamic braking with 300-hp wound rotor motors was made by substituting frequency control for current-control equipment that had become obsolete. This resulted in greatly reduced motor maintenance. These cranes are of the single-motor hoist type, which requires a 48-in. band friction clutch to join the hoisting and closing cable drums. The bass wood clutch band blocks were replaced with cast iron to receive the lining and have been in service for years without replacement. When wood was used, the life was measured in months. Anti-friction-type bearings on the pinion shafts of the hoist motors have paid for themselves over and over when compared with sleeve-type bearings.

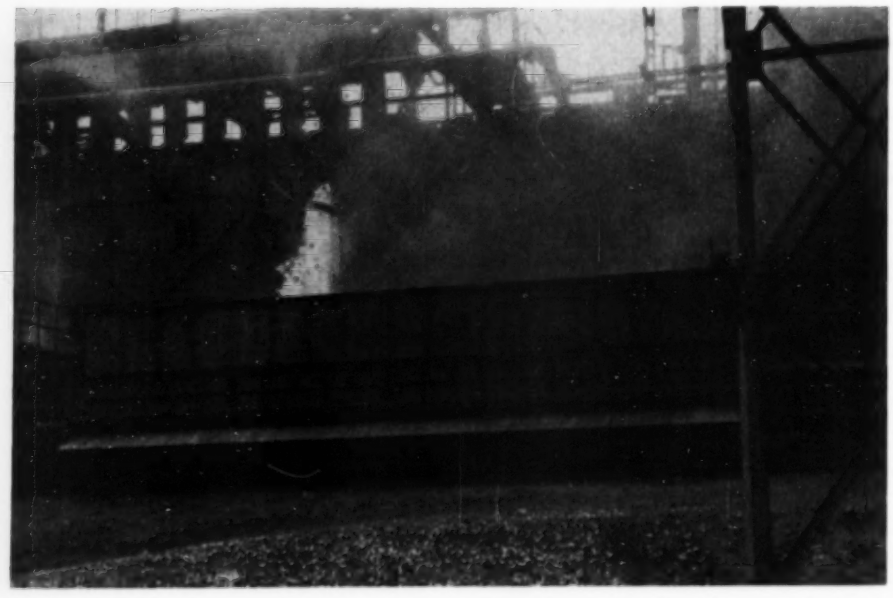
Crane wheels subjected to heavy loads require regular inspection to measure decreases in diameter due to wear. Uneven wear is likely to cause the crane structure to twist or go askew, with one leg traveling at a different rate than the other. At a certain plant, after considerable work had been planned in order to strengthen a crane structure to stop vibration, it was discovered that the trolley had flat spots on the wheels. New wheels ended the trouble.

The coal passes from the crane bucket to the coal hopper on its way to the conveyor system. The steel lining of the hoppers will require more or less work, depending on the hardness and size of

Mr. Wadleigh joined the gas production department of Consolidated Gas Co. of New York in 1924. Since 1926, when he transferred to the new Hunts Point plant, he has been closely associated with operation and maintenance of the by-product coke oven and carburetted water gas operations as superintendent of power and maintenance.

Fig. 4. The corrosive action of coke-quenching water on the coke-quenching cars is one of the worst enemies of the maintenance engineer.

Fig. 3. Heavy railroad-type open-air cars with air-operated side-dump gates are used as quenching cars.



the material handled. Belt conveyors of the troughing type, supported on idlers equipped with anti-friction bearings, are in such general use that little comment is needed here. When properly cared for, well-made belts will give years of service and handle millions of tons of coal. The conveyor belt must run evenly and be kept in proper train by idler and pulley position and take-up adjustment.

The use of side-guide idlers to train a belt is not recommended and should be only a last resort as damage to the belt edge will allow moisture to enter between the plies. Mildew and rot will take years from the life of the belt. Damage of this nature can also be caused by caused by the loading and discharge chutes when the belt is not trained properly or if the chute is poorly designed. Metal fasteners are used when it is not possible to vulcanize the belt into a one-piece units. There are several varieties on the market which serve different purposes. The fastener should be selected that will grip the conveyor belt carcass firmly with maximum resistance to tear. Flexibility is particularly important as pulley diameters are not always sufficiently large. Belts vary in thickness depending upon the number of canvas layers, or plies, and the thickness of the rubber covers; therefore, select the fastener that is designed for the particular belt.

Coal for by-product coke oven use is crushed and pulverized to a fineness of approximately 70% through a test screen having ⅛-in. clear square openings. This is usually accomplished by the use of Bradford breakers and hammer mills. Maintenance work will depend on the hardness of the coal and the pulverization desired. Regular inspection should be made of the lifting shelves and deflectors in the breakers to maintain proper coal flow and to prevent loss of coal with the reject material. Hammers in the pulverizing mill are usually of manganese steel with renewable tips, and the life of the perforated screen plates can be materially lengthened by rerolling so that both sides of the curved plates are used.

The next step in the journey is through the mixing bins and thence to the storage bins and into the charging car, which runs on steel rails on top of the coke oven batteries. The even flow of coal from the triple hopper car into the oven is desired. The best solution to this problem was found to be the installation of stainless steel liners.

Coke ovens are structures of silica brick erected in groups or batteries. Maintenance work is of a specialized nature and is devoted particularly to retaining a good surface on the interior walls and floors so that there will be the least resistance to the movement of the coke when the pusher machine discharges it from the oven. Leakage of gas through the joints in the walls into the heating flues must be guarded against. Patching and jointing with suitable refractory cement is done at accessible locations. More or less major work requires that several ovens on either side of the one to be repaired be taken out of service as protection against heat. Cooling and reheating silica through critical expansion temperature range is undesirable as extreme damage can result. Proper selection of coals and careful control of oven heating together with protection against undue strains transmitted to the walls when pushing the coke from the ovens will greatly increase the economical life of the batteries and make the maintenance work less in later years.

It is at this point that the coal will divide into coke and gas and go many ways, thereby causing the maintenance engineer no end of headaches as well as opportunities.

Let us leave the gas for a moment and follow the coke travel.

The heavy-duty machinery that is used to push the coke from the ovens at the end of the carbonizing period is the first equipment exposed to the abrasive action of the coke (see *Fig. 2*). The ram head and shoe, which support the ram on its 40-ft travel through the oven, are cast steel, hard-surfaced by welding to protect the castings and to assist in smoothing the oven floor. To smooth out a repaired floor, a cutting edge of hard surfacing material has been welded to the sides of the ram shoe with successful results. Several hard-surfacing materials are available, and it is a good idea to keep informed on the latest

abrasion-resistant materials. (Coke may be likened to a combination of eggs and carborundum. The nature of the coke will, however, depend on the coals used, the length of the coking time, the width of the ovens and other factors.)

In addition to the pusher machine, other heavy machinery units are required for the coke operation. The coke quenching cars, which receive the 10-ton charge of coke at a temperature of 1800° F, are heavy railroad-type open-top cars with air-operated side-dump gates *(Fig. 3)*. Each car is drawn by a 20-ton electric locomotive. The cars are lined with heat- and abrasion-resistant material, which is usually a good grade of cast iron *(Fig. 4)*. This material quite often serves the purpose in the most economical way as the higher cost of alloy materials does not always justify its use.

One of the worst enemies of the maintenance engineer on this type of equipment is the corrosive action of the coke-quenching water. After each oven charge of coke (approximately 10 tons) has been caught in the quenching car, it is subjected to a spray of 5000 gals. of fresh water *(Fig. 5)*. About two-thirds of this water is collected in settling pits and reused, and it becomes highly corrosive as a result of the direct contact with the hot coke, which contains a small percentage of sulfur. The amount of sulfur will depend on the coal used. The steel of the quenching car must withstand this terrific punishment.

In recent years some of the structural members of the cars have been constructed of lightweight anti-corrosive material on an experimental basis. This means of protecting against corrosion would be a great improvement over the old days, when experimenting with different kinds of paint was the practice. In later years, painting these cars became so expensive that it was discontinued, and a washing with fresh water followed by an oil spray when a car was removed from service was adopted as a measure that was thought to be as good an answer as any.

A serious problem, a good many years ago, was the frequent replacement of impellers on the pumps used for returning this quenching water to the overhead spray tank for reuse. The material was changed from cast iron to a chrome nickel alloy, which resulted in an increase in service time of from six weeks to several years. Another money maker at this location was found in the starting compensators for the electric motors that drive the quenching pumps. These starters were located below yard level in the pump room and suffered frequent damage by water. The location was changed to a higher level and the contact tips changed from cadmium-plated copper to a tungsten alloy face, which increased the life of the tips from seven weeks to six months. The compensators start a pump motor every seven to nine minutes for 24 hours a day and 7 days a week, and have been in service since 1930.

Among other items that have aided in the economical maintenance of coke oven machinery was the use of gaskets and a sealing material to protect the reversing machine motors against electrical grounds caused by coke dust. A counter-weighted arrangement of the quencher car locomotive collector shoe supports provided increased vertical travel to compensate for variable third-rail elevation on different batteries of ovens. This change greatly reduced collector shoe damage. Also, the use of a copper strip brazed to the steel power rails at standby locations for certain units saved the maintenance forces many trips to aid in putting a machine in service which had become isolated by a little rust.

Maintenance of coke oven machinery is a continuous function, as the ovens cannot be removed from service while the operating equipment is taken apart for repairs. Daily, weekly and monthly inspections are a regular part of a good maintenance organization and serve to prevent many unnecessary delays, particularly in the type of service under discussion. For example, the reversing machines, which re-position valves on each battery of 37 ovens at 20-minute intervals, are motor-operated through gear trains and a series of steel cables. This equipment is inspected on a weekly basis for correct cable tension and signs of wear. The numerous limit and over-travel switches are also inspected each week. Repairs are made as required by the inspecting mechanic and a check list turned in to the maintenance supervisor.

Traction gear on heavy machinery is also a major item. This includes rolled steel wheels, axles, journal bearings, and draft gear. The coke pusher machine, most important in this respect, is a rigid frame structure mounted on four 33-in. diameter wheels, two of which are drivers and two trailers. It is essential that the driven wheels be of the same diameters. Poor results were obtained with rim-toughened rolled steel as frequent replacement was necessary to maintain even diameters. This costly work was reduced by substituting chrome vanadium rims for rolled steel on the two heavily loaded wheels.

To avoid machine outage for an extended period, wheel replacement can be made in one day by assembling wheels, journals, bronze bearings, and

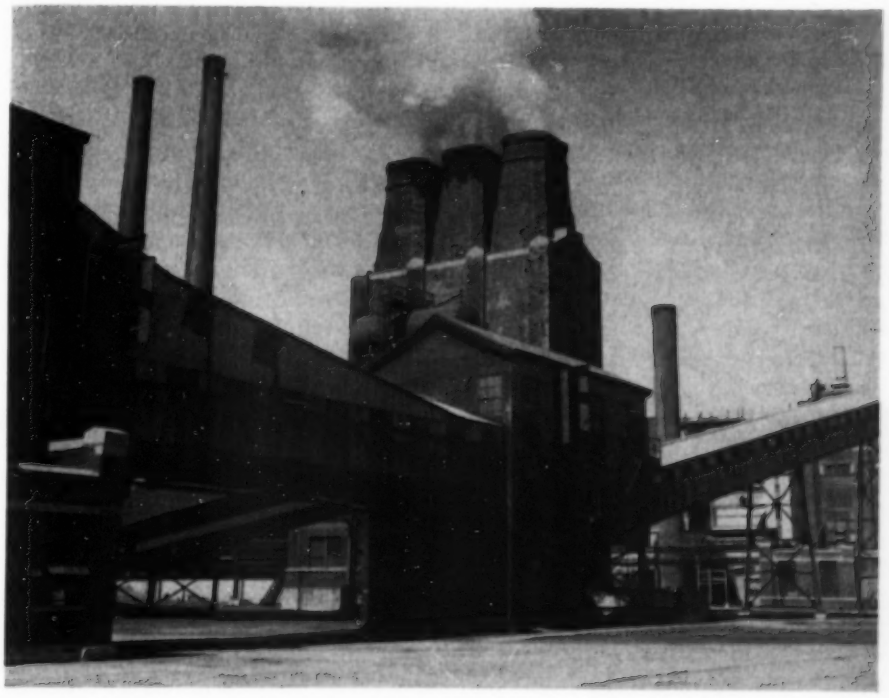


Fig. 5. Coke-quenching station. Each oven charge of coke is subjected to a spray of 5000 gal. of fresh water, a large part of which becomes highly corrosive as a result of the direct contact with the hot coke, which contains a small percentage of sulfur.

Fig. 6. Chutes are usually lined with a hard Kittanning clay brick, which withstands abrasion better than other material on an economy basis.

rigging in advance. A rigid machine of this type requires the use of jacks, in contrast to a flexible crane structure which can be run up on nickel steel wedges with one pair of wheels being dropped out at a time without the use of jacks. Track alignment must be carefully maintained to keep the pusher ram in correct relation to the oven floor. The upkeep cost and methods used will vary with the type of installation.

The handling of coke from the ovens to the ultimate plant destination is a continuous battle with corrosion, abrasion, and heat. These conditions are quite different from those encountered with coal. Conveyor belts are designed especially for this particular service and the recommendation of a reputable manufacturer is the best guide to follow. The selection should be made, however, by an experienced person who is familiar with the installation and service conditions. A high-grade tough heat-resistant rubber construction is most suitable for locations near the coke wharf where heat and moisture are factors. Considerable improvement has been made during the past 20 years in belt manufacturing, as evidence the fact that the transporting of 1 million tons on a coke wharf belt was formerly considered good service whereas 3½ million tons or more is possible now. This, of course, will depend on the design of the conveyor structure and the care given to the belt during day-to-day operation. The inclusion of a breaker strip in the belt cover is desirable as this resists tearing and thus aids in the prevention of rotting of the inner plies of duck. Small spot fires in the coke should be extinguished promptly as even the best belt can be ruined by carelessness in a short time.

The design of the discharge and loading chutes is most important. Frequently failure of a chute to empty itself can shorten the life of a conveyor belt immeasurably by causing tears and rips as the coke piles up against the belt. Belt damage caused by accidental chute blockage can be minimized by the use of a curved steel plate suspended above the chute on a horizontal rod, which actuates a limit switch to re-energize the conveyor motor when coke strikes the suspended steel plate. Even the very best chutes are occasionally blocked by large pieces of coke. A properly designed loading chute will reduce wear on the belt cover by distributing the coke evenly over the surface and at, or near, a velocity equal to the belt speed.

Chutes are usually lined with a hard Kittanning clay brick (see *Fig. 6*), which withstands abrasion better than other material on an economy basis. This brick can be laid with a mortar of one part plaster of Paris and 20 parts Portland cement. The mix sets quickly, which makes it possible to use the chute immediately after repairs have been completed. Various alloys, glass, and rubber have been tried, but the brick is far superior and patterns for castings are not required. In locations that are subjected to abrasion and are not suitable for bricking, such as the wearing surface of a flop gate, a rolled alloy steel plate is satisfactory.

Troughing idlers, return idlers, and pulleys are rapidly worn out by the combination of abrasion and corrosion. Rubber-covered return idlers and snub pulleys will give excellent service and are well worth the extra cost. Rubber-covered troughing idlers are used with good results at loading points to minimize impact damage to the belt, although this is more necessary for coal than for coke. It is particularly necessary to remove as much as possible of the fine coke that adheres to the returning side of the belt. In wet locations this acts as a grinding compound and will wear out the idlers and pulleys in a short time. This condition is aggravated in freezing weather when masses of frozen coke breeze frequently build up unevenly on rolling parts and cause the belt to run out of train. Severe damage can result from such a condition. To remove this material, belt wipers made from parts of old conveyor belts are placed against the underside of the conveyor, being held by counterweights or springs. Separately driven rotating brushes can also be used, but they are not usually satisfactory and require more maintenance.

Coke is separated into sizes suitable for use or sale with grizzly, shaker, and vibrating screens. The rotating discs for grizzly screening equipment are cast of an alloy or chilled cast iron. The choice is one of economics, as there are several suitable materials that give good results. Woven wire screen cloth, as used on shaker or vibrating screens, is obtainable in various alloys. Each manufacturer generally has his own type of abrasion-resistant wire and as several are suitable it is a question of the cost of replacement labor, length of life, and cost of the material. The principal fault is that of making the wire too brittle to gain hardness. In the smallest sizes of coke, corrosion is a greater factor than abrasion because of the high moisture content of the coke breeze.

Reference was previously made to the use of belt fasteners for coal conveyor belts, which is a relatively simple matter. Coke service, however, is much more severe, and a careful daily inspection of all fasteners is necessary. One broken fastener can do hundreds of dollars worth of damage to a conveyor belt if allowed to go unnoticed.

After the coke has been separated into the usual sizes it is distributed by conveyor belt to the water gas generators, steam boilers and gas producers.

(Continued next month)

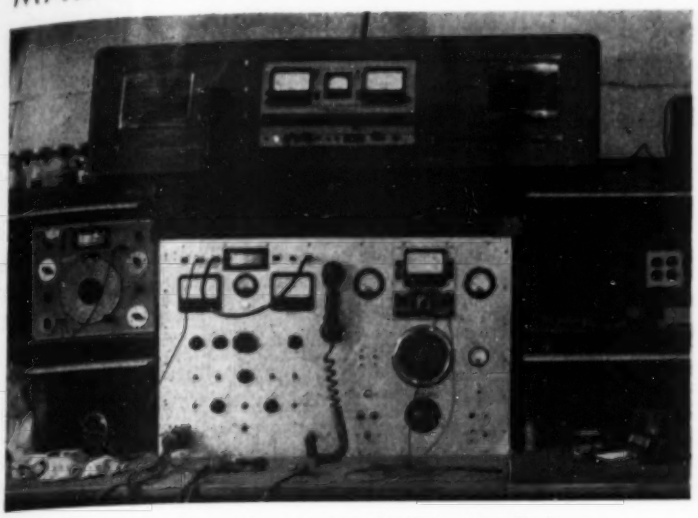


Fig. 1. Complete mobile radio unit test facilities installed in the Birmingham radio shop.

Fig. 2. The field strength meter used for final check on mobile transmitters.

Preventive maintenance schedule keeps Alabama Gas' radios operating

By T. G. **HUMPHREYS, Chief Radio Engineer** • Alabama Gas Corp., Birmingham

The growth in mobile radio usage in gas companies has not been a completely unmixed blessing, what with the problems of maintenance of complex and delicate equipment. High-quality maintenance to prevent outages must be secured at a cost that will not be so great as to offset the advantages of the equipment itself. Some companies are still bedevilled by this.

When utility companies began adopting mobile radio, several avenues of approach to the solution of the maintenance problem presented themselves. It was possible, in some cases, to contract maintenance from individuals or organizations equipped to perform the service at a nominal fee and to delegate the administrative duties to someone already in the organization who might be able to handle them in addition to his normal functions. In recent years it has been possible to lease equipment and maintenance service from common carrier companies, but the licensee is still entirely responsible to the FCC for compliance with regulations, proper licensing, etc. A third possible solution was to establish a new communications or radio department that would be responsible for all matters relating to the radio system. This is the story of one company that chose the latter course and ultimately realized far greater benefits from it than had been anticipated.

IN general, there are two schools of thought regarding radio maintenance. One advocates letting the equipment operate as long as it will without attention and making repairs only when a breakdown occurs. The other proposes a program of preventive maintenance wherein the equipment is inspected at regular intervals and repairs made before a failure occurs. Both these plans have been tried at Alabama Gas Corp., but the latter course is now rigidly adhered to. It is believed that radio is now too valuable and many operations are too dependent on its performance to allow breakdowns to occur except where they cannot possibly be avoided.

There are two maintenance schedules for radio and other equipment. In the plants outside of Birmingham, inspections are made once each month by a technician who travels from plant to plant over a five-day period. So that all the men will be familiar with all the equipment, and to avoid undue hardship on any one individual, these trips are rotated among the three men. But in the Birmingham plant, where the company's only radio shop is located, all apparatus is checked once every three months since it is felt that longer periods between inspections may be tolerated where maintenance personnel are always readily available.

At the radio shop in Birmingham, a special radio test panel was constructed at the time the system was changed from AM on 31.46 mc in 1950 to FM on the present frequency, 158.25 mc, and is equipped to accept all units used by the company. The panel (see *Fig. 1*) contains a power source providing filtered dc from 0 to 19 volts at about 20 amperes. It also contains a semi-variable

GAS exclusive

Radio maintenance ... An experienced serviceman can complete the entire check in about 20 minutes

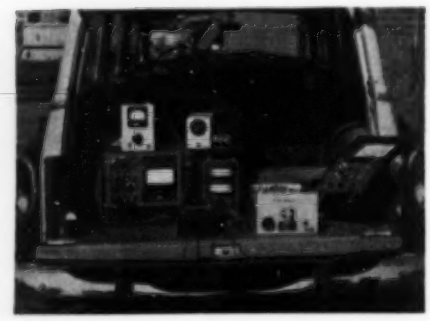


Fig. 3. Close-up of radio testing gear for use in properties outside of Birmingham.

crystal-warp-type oscillator whose output is variable from 0 to approximately 100 microvolts in two coarse steps with a fine adjustment for any desired signal level. A test speaker is included as is a relative audio output meter. A standard type volt-ohm-millimeter instrument is built into the panel and a conventional radio unit test set constructed along the lines of the one supplied by the radio equipment manufacturer is also included. This instrument has an additional refinement in the form of a center zero 50-microampere-type meter, which is at all times connected to the discriminator of the receiver. A highly shielded dummy antenna with an associated relative RF power output meter permits transmitter tuning without disruption of the communications circuit, and indicates the power capabilities of the transmitter. A complete control head assembly including microphone, volume control and squelch control is, of course, an integral part of the panel.

Mounted immediately above the test panel is a Motorola combination modulation and frequency meter, which contains a 5-mc and 10-mc receiver for WWV, thus facilitating accurate calibration. A series of coaxial fittings along the top of the test panel allows this meter to be connected to the dummy antenna, the receiver test oscillator, or a ground plane antenna on a mast above the shop.

Just below the frequency meter is a series of controls which allows the test panel to be used as a dispatch point on the Birmingham base station. Intercommunication with the radio operator is also possible from this point.

To insure that the radiating system of a vehicle under test is performing properly, there is installed on the wall just outside the shop a field strength meter *(Fig. 2)*, which is simply an old 10- milliampere X-ray meter with a tuned antenna and diode rectifier, but it effectively indicates the amount of radiation from a vehicle in its vicinity.

"System maintenance" is emphasized. Not only must the radio unit itself be kept in good condition, but the radiating system and the primary source of power, which is, of course, the car or truck battery, must also be properly maintained if the system is to operate at maximum efficiency. Accordingly, the automotive battery, generator, and voltage regulator are regularly checked as are the wiring, fuses, etc. Voltage regulators are set for a maximum of 7.0 to 7.2 volts at the battery and current is limited to the maximum amount appropriate for the generator.

It might appear that the checks outlined above are excessively time-consuming, but an experienced man can complete the entire routine in about 20 minutes unless excessive trouble is found. Tubes are changed only when their condition impairs the performance of the unit and, in fact, some tubes are still in use after six or more years of continuous service. Vibrators are changed when they fail to deliver a minimum predetermined voltage with supply voltage reduced by 25%, or when they are slow to start or give any indication of "sticking." Rattling speakers, packed microphone cartridges, and corroded fuses are also changed.

It is interesting to note that the company has no complete spare units. All units are kept in service, since nearly 14 years' experience indicates no need for the spares. The philosophy of "give a man a crutch and he will surely use it" seems quite applicable and it is a matter of great pride with the men that they have no crutches.

Inevitably, in an operation of this type, some slack periods will occur and although they are now rare indeed several methods have been devised to use such time profitably. Among these methods is a program of vibrator repair, which has had quite surprising results. It was stated earlier that vibrators were removed when they failed to deliver proper voltage, which is long before they fail. It has been found that they can be restored to their original operating condition by simply cleaning the points and adjusting them while observing voltage, current and waveform on an oscilloscope under the actual conditions of normal use. In almost every case such restored vibrators deliver a higher voltage for a longer period of

In 1941, the Alabama Gas Corp. (then Birmingham Gas Co.), recognizing that World War II was almost inevitable, began a search for methods and apparatus that would make it possible to use a greatly reduced labor force in the most efficient manner. One of the possibilities was mobile radio and application was made to FCC for two base stations and 25 mobile units to operate in the "special emergency" service, which, at that time, was the only category open to utilities.

T. G. Humphreys

The author, who was then employed by a broadcasting station but who had previously worked for several years in the communications department of the local police agency, was employed by the gas company to supervise the installation of the equipment and perform maintenance and other duties as required. Station licenses were obtained and the system was placed in operation on Dec. 8, 1941, with Mr. Humphreys, who then held a first-class radiotelephone operator's license, operating one of the base stations and maintaining the equipment.

The present system consists of 10 base stations at local plants throughout the area of Alabama served by the company, and approximately 150 mobile units.

The radio department has expanded to four men, including a chief radio engineer and three technicians, and is now responsible for all matters pertaining to radio as well as telemetering and supervisory control and diverse other functions. It serves as a valuable adjunct to the general engineering department by performing tests on coatings, fittings, etc., for corrosion mitigation and assisting in the establishment of procedures and criteria for cathodic protection of underground plant.

time than they did when new. This, it is believed, is because, in the reworking, contact arcing is reduced to an absolute minimum. Since this repair doubles (at least) the useful life of the vibrator and only requires about 20 minutes to complete, it is indeed profitable, since a new vibrator costs about $5.

While the preceding has dealt almost entirely with routine maintenance of units in the Birmingham plant, it applies equally well to those in the outlying plants. The equipment is somewhat different, however. Wherever possible, portable equipment operates from self-contained batteries and is not tied down to either commercial power or the maintenance vehicle. The vehicle normally used is a station wagon *(Fig. 3)* in which is carried a full stock of replacement tubes and parts as well as the following test equipment:

A Link combination frequency meter, modulation meter, and signal generator.

A Motorola P-8501-A combination test set.

A tuned RF probe.

A Simpson model 260 VOM.

A 0-10 and 0-50 ampere meter.

A portable shielded dummy antenna with relative power indicator.

A condensed combination test meter.

A portable automotive generator and regulator test set.

A Hewlett Packard audio oscillator.

(All necessary hand tools including electric drill, soldering iron, dehydrating air pump for transmission lines, etc., are, of course, included.)

The station wagon itself has an alternator-rectifier for battery charging and equipment has been installed to utilize a portion of this power to deliver about 100 watts of 120-volt ac power for operating small power tools where commercial power is not readily available. It should be mentioned at this point that all tools, test apparatus and other equipment necessary for the performance of the work are supplied by the company.

All radio equipment used by the company up to the present is manufactured by Motorola and includes units ranging from the earliest "dispatchers" to and including the newest "Uni-Channel" multi-voltage units. Rather complete maintenance records are kept on each unit by company-assigned serial number from the time it is purchased until it is ultimately retired (see *Figs. 4* and *5*). Two form are used, one on which the actual maintenance records are kept and another which contains only meter readings on both transmitter and receiver. It is thus possible to ascertain quite easily the performance of any particular unit throughout its useful life. The use of these records also complies with the rules and regulations of FCC.

Form 16-18A

Serial Number

Model Number

ALABAMA GAS CORPORATION
MOBILE RADIO UNIT MAINTENANCE RECORD

KA 6200

Car Number	Reported Date	Reported By	Nature Trouble	Remedy	Station	Date Cleared	Engr. Sig.

Fig. 4 (**above**) is a copy of the actual maintenance record of all the radio equipment.

Fig. 5 (**below**) contains only meter readings on both transmitters and receivers.

Form 16-18B

ALABAMA GAS CORPORATION - MOBILE RADIO RECORD

Serial No. KA 6200		TRANSMITTER										RECEIVER						SUPPLY VOLTAGE		GENERAL		MODEL
CAR NUMBER	DATE	1	2	3	4	5	6	Ip	Ep	Mod	Freq Dev	2 Sta-tic	2 Dyn	3	4	5	6	Low	High	Qual	Mech	ENGR. SIG.

ER. It is thus possible to ascertain quite easily the performance of any particular unit throughout its useful life. The use of these records also complies with the rules and regulations of FCC.

Maintenance of the base stations is similar to the program used with mobile units. These stations consist of one 250-watt remote controlled unit, one local and two remote-controlled 60-watt stations, one remote-controlled 30-watt station, four local-control 30-watt units and one 25-watt local-control station. The work follows the same schedule as that of the mobile units with the exception that, in addition to normal routine inspections, once each year every station is very carefully gone over and extensive tests made to bring it to top efficiency.

It will be noted that an audio oscillator was included in the test equipment carried in the maintenance vehicle. It is required for checking tone-channeling equipment used for telemetering and control and also for checking single-tone selective call apparatus used in most of the plants to eliminate nuisance interference between base stations. Wherever it is used, each car is equip-

Radio maintenance... Gasoline-driven generator supplies power for radio operation

ped with a one-tube single-tone generator, which transmits a tone for ⅓ second at the start of each transmission and operates a decoder in the base station, which in turn actuates the loudspeaker. On the company's radio system, two tones are employed for this purpose and a selector switch on the control head provided for switching from red (1800 cps) to blue (2200 cps). This has been highly successful and is extremely popular with the base station operators. The equipment was also purchased from Motorola.

As required by the regulations, base station maintenance records are kept at the station control point. Mobile records are all normally kept in the radio shop in Birmingham.

Limited failures

In spite of the best routine maintenance, there will be a certain number of breakdowns between inspections, although these failures usually involve only a defective tube, vibrator or fuse. For this reason, a small stock of tubes and certain other parts is kept at each outlying plant and one of the supervisors is taught how to change obviously defective items of this nature. If a repair is beyond the scope of his knowledge, a man is immediately dispatched from Birmingham to effect the repair. To save time, it is not uncommon for the driver of a car with a defective radio and the technician to meet on the highway at a point halfway between the two cities. Such cases only occur four or five times in a year, at the most, and consequently do not present much of a problem. Base station outages are, of course, handled immediately by a technician from the radio shop. They, too, are so rare as to be of no consequence in the overall planning.

No actual unit-by-unit cost records are kept as such since the cost of maintaining such detailed records would far outweigh their usefulness and essentially the same information on any particular unit can be obtained directly from the service records.

Earlier it was stated that both preventive and breakdown maintenance had been tried and the former adopted as standard procedure. More than 13 years of experience indicates that this pays off, not only in a very great reduction in number of failures and consequent lost time but also in a direct reduction in maintenance costs. This may be partially ascribed to virtual elimination of loss of expensive component parts, such as power transformers, that may occur as a result of stuck vibrators, etc. It is certainly significant that in all the years the system has been in operation, only one power transformer has had to be changed, and this occurred because the vehicle was accidentally driven into flood waters and remained so long that the unit was thoroughly saturated. While it would be difficult to quote exact cost figures, it appears that labor and material charges per month for each unit would average about $7. Even when amortization charges are added, the net overall cost is still less than half the usual stated charge for leased service from communication companies.

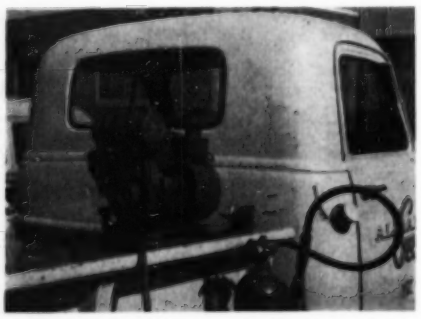


Fig. 6. Supplementary gasoline-driven battery charging generator mounted on a truck.

An additional and sometimes quite annoying problem that almost certainly arises in every gas company is that involved in keeping a radio on in a heavy construction truck during the entire day without completely running the battery down. Aggravated by the fact that such trucks are usually driven only a short distance during a day, the problem has been serious enough to be the subject of considerable study by communications engineers and transportation superintendents throughout the industry. Many novel schemes for alleviating the problem have been suggested and tried. Among these are extremely heavy batteries, high-current charging devices such as alternators, small pulleys on standard generators so that a fair charging rate may be realized from the engine running at a fast idle, and many others. Our company has devised a different and unusual solution that has functioned satisfactorily.

A number of gasoline-operated generators rated at 60 amperes were purchased from army surplus at a cost of about $15 each. These were reconditioned in the automotive garage and installed in a convenient place on the heavy trucks *(Fig. 6)*. Wired into the truck's electrical system, they are operated when it is necessary for the truck to stand for long periods of time. Total installed cost including reconditioning came to about $50 each. Depending on the charge rate, they operate four or five hours on one-half gallon of gasoline. Equipped with lawn mower-type mufflers, they are relatively quiet and do not interfere with the radio. In any event, they could not compete with the noise of an air compressor and jack hammer, which are usually operating.

Long-life tubes

On several occasions, studies have been made to determine the feasibility of using some of the ruggedized long-life tubes currently available. As yet, none have been used since the failure rate of standard tubes is rather good and it would be exceedingly difficult to justify the very much greater cost of the special tubes. It is possible, however, that some may yet be employed in equipment in fairly remote areas.

One point that probably should be clarified is the apparent discrepancy between the quoted maintenance cost figures and the number of men employed. This is easily explained by the fact that the technicians spend, on an average, only about 25% of their time maintaining radios. The rest of the time is consumed in constructing and maintaining telemetering and remote supervisory control devices and automatic controls on such apparatus as propane plants employed for standby, conducting tests related to the construction and operation of equipment on the gas distribution system, and repairing such diverse devices as pipe locators, leak detectors, inter-office communication systems and sundry other apparatus. Daily time tickets are used whereby the time is accurately and appropriately charged. ■

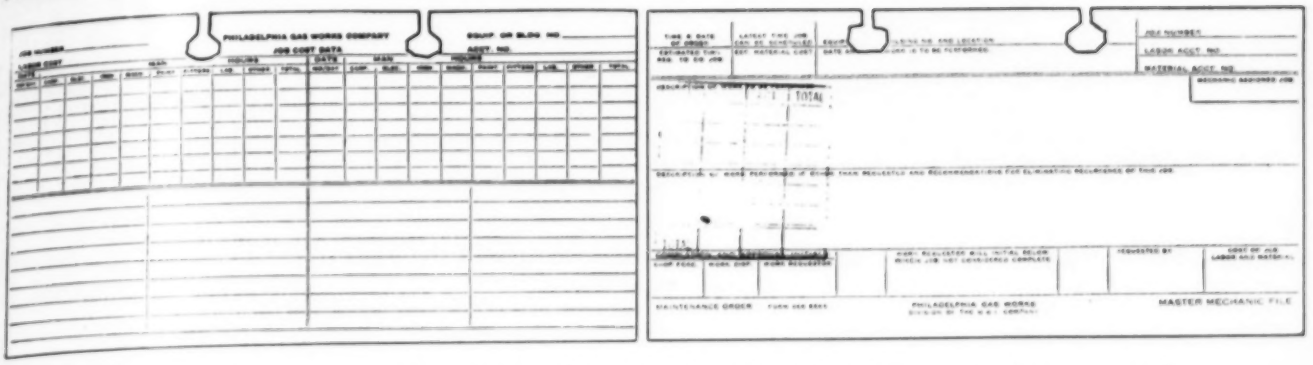


Fig. 1. The maintenance order form, which outlines the work to be performed by a particular shop or craft.

A maintenance system for mixed gas plants

By O. B. HOLMAN, Assistant Process & Maintenance Engineer
Philadelphia (Pa.) Gas Works Division of United Gas Improvement Co.

WITH natural gas becoming available to the gas industry throughout the country in ever increasing quantities, what is happening to the gas manufacturing equipment? In Philadelphia, at least, it is still there and operating—and still needing maintenance attention. In many ways, maintenance has become a more serious problem than ever before, simply because of the coming of natural gas.

Plant improvements and additions are being made at a rate comparable to most any era. The reason for this is that the increased demand for gas since the availability of natural gas in this area, in terms of comparable heat units, has surpassed that available from natural gas on a peak sendout day. Even though natural gas furnishes about 88% of the annual thermal requirements, the sendouts are such that at peak load it furnishes only about 57%.

Some of the major plant improvements that have been made are:

1. Natural gas handling facilities.
2. Additional gas mixing provisions.
3. Large increases in the transmission pumping and aftercooling installations.
4. Catalytic reforming units using natural gas and light distillates (kerosene or gasoline) as a feedstock.
5. An oil gas set.
6. A liquefied petroleum gas installation as a standby fuel source in the event of trouble with natural gas.
7. Sizable increases in oil storage.

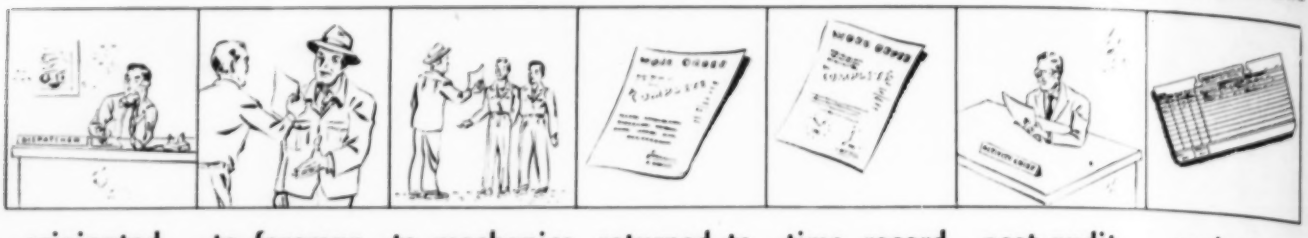
The natural gas is the basic energy source and gases manufactured from other fuels fall into the category of peak shaving gases. Nevertheless, the readiness and therefore the mantenance of the gas plant is as important as it ever was. As far as workload is concerned, because of the increased size of plant, it is greater than ever.

There are two gas production plants in Philadelphia of approximately equal size. In addition, there are five outlying holder stations, two of which are equipped with transmission pumping facilities. The main apparatus involved includes:

1. Four cyclic catalytic reforming sets.
2. One four-shell regenerative oil gas set (13 ft-0 in. OD).
3. Thirty-five carburetted water gas sets (8 mechanical grate sets and 27 hand clinkered sets. All of the mechanical grate sets and 8 of the hand clinkered sets are equipped for thermal reforming of natural gas).
4. Twenty gas engine-driven compressors ranging size from 800 to 2000 bhp.
5. Nine steam turbine-driven compressors ranging in size from 465 to 4100 bhp.
6. A river water system at each of the two plants totaling approximately 45,000 gpm.
7. A steam generating plant at each plant plant of approximately 500,000 lb/hr each. Included is about 185,000 lb/hr of high pressure steam (650 psi).
8. Twenty gas storage holders with a total inflated capacity of about 70 MMcf.
9. Two liquefied petroleum gas systems. One system contains 26 30,000-gal. tanks and the other 20.
10. All the auxiliaries and facilities required to accommodate the abovementioned apparatus such as blowers, exhausters, condensers, precipitators, purification, tar byproduct system, etc.

Since the operation of a large part of the plant apparatus has gone from a year around operation to one having about an eight-month idle period, maintenance as well as operating has changed. The maintenance and inspection procedures have to be more exacting and detailed. Peak load apparatus has to be available to run when called upon on short notice with no trouble or failure. There is little, if any, moderate load operation to put apparatus on in rotation for proving. During the period of idleness it is easy to forget a small, seemingly unimportant detail or

Flow of a maintenance order from origination to completion



originated | to foreman | to mechanics | returned to foreman | time record | post-audit review | equipment record

piece of equipment that can give a disproportionate share of trouble when operation is resumed. In addition, the accumulated running time on the apparatus is not of the order that the units can be given major overhauls annually to assure top condition for the coming load season without prohibitive cost.

To insure the availability of apparatus when needed, a program has been adopted to:

1. Provide a detailed system of operating checks and records.

2. Use a preventive maintenance inspection system to detect items needing attention.

3. Conduct a full scale plant operation, usually for a portion of a day, early in the load season as a "shakedown" run. This is accomplished by letting one plant and then the other take over as much of the load as possible in order to get all the apparatus on at the same time. Simultaneous operation gives a better test than a piecemeal one.

Since, as is experienced in most all gas companies, the gas load in the winter is many times greater than during the summer, it follows that maintenance has to be seasonal too. This, then, demands that the greatest number of operating personnel are needed in the winter and the greatest number of maintenance personnel in the summer.

Operators are not usually experienced maintenance people and vice versa. As time goes along this problem is being overcome by training people of one type to do work in the other. New employees are being selected with this aim in mind. In some instances it is stipulated as a condition of employment. At the present time a sizable number of men operate gas plant apparatus in the winter and work as first-class tradesmen in the summer.

Labor costs altered

With the advent of natural gas into our manufacturing processes, the pendulum of labor costs began to swing from production to maintenance. At one time, for example, the productive employees engaged directly in production operations constituted some 70% of the payroll and maintenance the remaining 30%. Now, however, the payroll relation expenses are divided about equally between production and maintenance.

This factor of the increasing importance of the maintenance dollar is accentuated throughout industry with the growth of automation. In our own case the changing nature of our operation, and in turn equipment, were additional motivations to a review of our methods for controlling maintenance operations.

Our initial objectives were threefold:

1. To improve the method of requesting maintenance work.

2. To determine a priority for these work requests.

3. To accumulate statistical data on costs and manpower requirements and, in turn, utilize these statistics for both budgeting and workload planning purposes.

Prior to the advent of our maintenance control system, the maintenance work was largely requested by the various operating chiefs directly to the shop foremen and/or master mechanic and in some cases even the plant superintendent.

Under such an arrangement it was impossible to determine a work priority system and/or an even flow of workload to the various shop foremen. The inherent interest on the part of a particular operating chief in the operating condition of his own equipment led to the establishment of a priority system in which the man who complained the loudest was quite likely to be serviced first.

Our first step, concurrent with the institution of a work order system, was the establishment within the organization of a work dispatcher, through whose hands passed all the requests for maintenance work.

Our plan basically hinged upon two major innovations within the then exist-

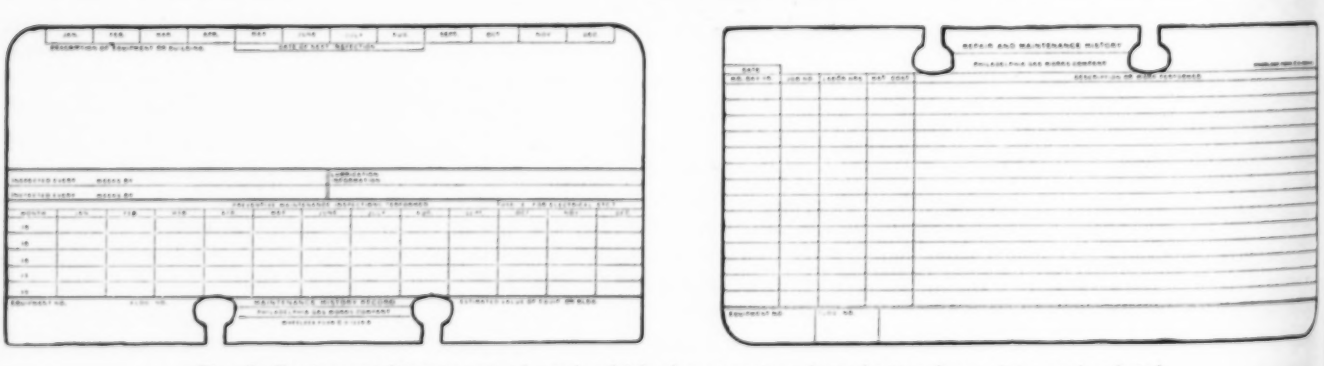


Fig. 2. Equipment history record card, which shows cost and productive hour data and a brief description of work performed.

ing maintenance system: (1) the establishment of a maintenance order form (see *Fig. 1*) outlining the work to be performed by a particular shop or craft; (2) and one of the most difficult steps from a personnel standpoint, the origination of a job clock system, a necessity for recording the time expended on a specific job by the maintenance personnel.

The normal flow of a maintenance order from the time of origination to completion is as follows:

1. The origination of the work order by the dispatcher from a telephone request by an activity chief.
2. The dispatching of this work order to the foreman.
3. The assignment of the work by the shop foreman to the mechanics.
4. The return of the completed work order.
5. The recording of the time and cost of the job on the work order from the job time clock cards.
6. The forwarding of the original work order along with material issue tickets to the requestor for post-audit review of the job cost and material usage.
7. The transfer of cost and productive hour data, and a brief description of work performed, to an Equipment History Record Card (see *Fig. 2*).

After accumulation, the basic data were utilized to formulate average times for performing the multiplicity of repetitive jobs normally required in a gas manufacturing plant. Currently we have some 60% of our maintenance work classified as repetitive. Average times are used for both planning manpower requirements and budgeting purposes. The standard time, along with the frequency of occurrence of a job, serves as a basis for the preparation of the yearly maintenance budget, in both productive hours and dollars. In addition to the normally accepted departmental financial cost reports, separate productive hour reports, including a manhours budget for each maintenance account, are issued by the general accounting department as a by-product of the timekeeping and accounting system. The basis for these yearly estimates stems from the historical data on the equipment history record file and the predetermined average times for repetitive work.

The historical records referred to above are kept on a Wheeldex as a reference file for determining the maintenance schedules on a specific piece of equipment by the utilization of a tab system. At the beginning of each month the file is reviewed for equipment scheduled for overhaul, inspection or repair during the month. The work dispatcher prepares maintenance work orders for the month as the result of this review, refers to the file on average time for performing the work and throughout the month dispatches the maintenance work orders to the foremen. Various planning statistics are compiled on a manhours basis showing blacklog of work, estimated new work during the month, and manhours available in the various shops.

In addition, this historical record has proven very useful in analyzing maintenance expense as related to a specific piece of equipment. It acts as a guidepost in determining policies on the replacement of high maintenance cost equipment, as well as the purchase of new equipment when it is obvious maintenance costs are prohibitive on a similar piece of equipment currently in use.

A subsidiary report emanating from the data accumulated is the productivity report *(Fig. 3)*. The report itself is not a firm measure of the productivity of a given shop but does act as a long range guide on productivity and workload over an eight-week period.

The report is broken down into the three categories of jobs—repetitive, non-repetitive, and estimated.

The repetitive work is exactly what its name implies, recurring jobs on which average data has been accumulated and it is utilized as a standard for a specific job. We estimate that approximately 70% to 80% of our maintenance work will eventually fall into this class.

The second category, non-repetitive, consists of those jobs requiring less than 40 hours on which an average is utilized on a daily basis, i.e., an average for one-day jobs, two-day jobs, etc., was determined and then utilized as standard. For example, the standard for two-day non-repetitive jobs is 11.5 hours.

The third category, estimated, are non-repetitive jobs requiring over 40 hours and which are estimated by the master mechanic and the foreman, utilizing their best experience.

The transition from the old to the new system was continuous over a period of several years. Several trial and error experiments were made on specific phases of the system so that today it is greatly simplified from that of several years ago.

The actual increased cost was not significant. Within each plant it was necessary to add one person, a work dispatcher.

One additional advantage, not a principal one, but of particular benefit to multi-plant utilities, is the comparison available of the manhours required to complete similar work in different plants. With the data available, we have been able to compare the time factors and bring the two plant maintenance personnel groups together in small committees. From the divergence of maintenance practices, the one simplest and least expensive way of performing a specific maintenance job has been determined. ■

STATION "B"
MAINTENANCE CONTROL REPORT

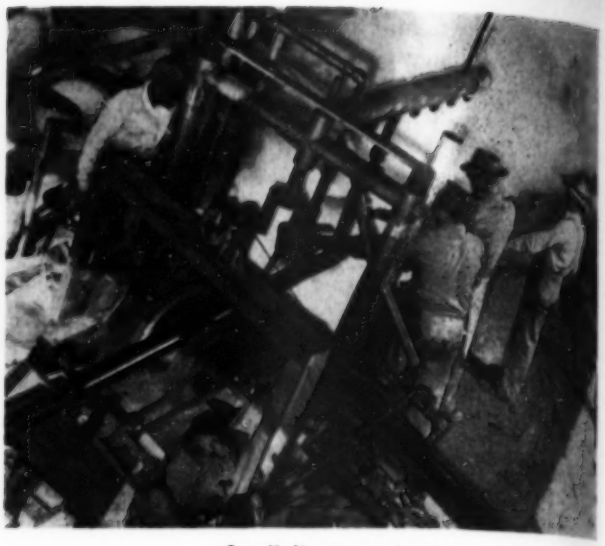
Period Ending Month 12 Days 21-31 Year 1954

		Current Week			Eight Period Running Average		
SHOP	CLASSIFICATION	BASE AVG.HRS.	ACT.HRS.	& PRODUC-TIVITY	BASE AVG.HRS.	ACT.HRS.	& PRODUC-TIVITY
25	Repetitive	468	447	105	7528	7811	96
Yard	Non-Repet.	2	2	100	117	135	87
	Estimated	-	-	-	1327	1407	94
	Shop Total	470	449	105	8972	9353	96
41	Repetitive	848	857	99	5402	5457	99
Boiler	Non-Repet.	41	42	98	209	211	99
	Estimated	56	57	98	602	613	98
	Shop Total	945	956	99	6213	6281	99
42	Repetitive	589	559	105	4195	3950	106
Pipe	Non-Repet.	-	-	-	376	438	86
	Estimated	-	-	-	1514	1392	109
	Shop Total	589	559	105	6085	5780	
43	Repetitive	557	569	98	7848		
Machine	Non-		23				

Fig. 3. Subsidiary maintenance control report, which acts as a long-range guide on productivity and workload over an eight-week period.

MAINTENANCE IS GOOD BUSINESS

How Houston Natural approaches distribution system maintenance



Small diameter pipe being coated with dielectric material to augment Houston's cathodic protection program.

By E. S. GEORGE, Vice President
Houston Natural Gas Corporation

"USE it up," "wear it out," "make it do" have been called three of the foundation stones supporting the greatness of our country. These three are often numbered among the "great New England virtues." However, that may be, we in Texas recognize in them not frugality alone but an element of prudence as well.

Make it do means fix it up, repair it, keep it running in satisfactory operating condition. The author of that phrase was talking about maintenance, and if you are a gas distribution company with up to 85% of your total assets in property, plant and equipment, you quickly get mighty, mighty serious about the problems of maintenance, and how to solve them.

Just plain pipe, in the ground, may represent a substantial part of the total investment of a distribution system property, depending upon the concentration of population, difficulty of construction and other factors.

It is particularly significant from a maintenance standpoint that of Houston Natural Gas Corp.'s $35 million property, plant and equipment evaluation, more than 70% is represented by pipe in the ground. And it should be obvious that if 70 cents out of each plant dollar goes for pipe, the protection of our underground pipe system is the principal object of the entire maintenance program.

The Houston Natural operational system consists primarily of 3500 miles of production, transmission, and distribution lines carrying gas to more than 200,000 customers in a 20-county service area spread along the Texas Gulf Coast. The area outside of the Houston metropolitan district is comprised of 17 districts. Each district serves three or more towns and is managed by a local district manager, with headquarters in the district office.

The pipe represented by these figures is buried in a variety of soils, but a major part of it is right along the coast where conditions are most undesirable. Extreme conditions, wherever encountered, may force careful maintenance, but these same conditions also offer the added inducement of a considerable extra return for the effort expended on maintenance.

Certainly, under the adverse conditions encountered, it is prudent for Houston Natural to exercise diligence in maintaining its pipe in order to protect a very substantial investment.

Preventive and corrective maintenance

The continuing program of maintaining our system, both underground piping and the aboveground installations, such as meter and regulator stations, buildings, etc., consists of two general phases: (1) preventive maintenance and (2) corrective maintenance, with much greater emphasis placed on the first (it is particularly true in maintenance that an ounce of prevention is worth a pound of cure) and with considerable overlapping of the two at times.

The preventive maintenance of this underground piping system is undertaken by two measures: (1) application of a protective coating to all pipe before installation, and (2) isolation of new additions to the system into electrical units and the installation of cathodic protection to mitigate the effects of electrolytic corrosion.

Although there are small quantities of bare steel pipe remaining in some of our older town plants, and also small amounts of cast iron pipe, all pipe installed in recent years has been coated and wrapped steel pipe, laid with all joints welded.

Pipe in sizes 4½-in. OD and larger is usually grade B seamless, while 1¼-, 2-, and 3-in. can be welded pipe. Our chief reason for specifying grade B seamless in the larger sizes is that pipe may be taken from inventory, to be used either in a transmission line operating at 500 psi, or in a distribution system operating in our normal intermediate distribution pressure range of 10-50 psi.

Pipe coating and wrapping

All pipe is coated and wrapped by contractors at their plant locations. Two sets of coating and wrapping specifications are used: H.N.G. Specification 1 on 1¼-, 2-, and 3-in. diameter pipe, and H.N.G. Specification 2 on 4½-in. OD and larger. Descriptions of these specifications are shown in the box on page 65.

As will be noted, the basic coating material used on 1¼-, 2-, and 3-in. pipe is an asphalt base enamel, while a coal tar base enamel is used on 4½-in. OD and larger pipe. It has been thought

that the smaller diameter pipe, being subject to greater flexing and bending in handling, should be coated with the more elastic, less brittle asphalt base enamel, whereas larger diameter pipe, being less subject to such flexing action, can be coated with the harder coal tar base enamels.

The above by no means represents our final opinion on coating and wrapping specifications since we are currently making a detailed study of coating and wrapping methods, materials, and specifications, with a view toward improving this important part of our maintenance program.

We mentioned earlier that more than 70% of Houston Natural's investment in physical property is in pipe. It is further estimated that about 5% of total current expenditures for plant investment goes for protective coating and wrapping of pipe.

The second step in the preventive maintenance of new pipe installed is the application of cathodic protection. Although some of our transmission lines were placed under this type of protection about 10 years ago, it has only been in the past five years that we have undertaken an aggressive corrosion mitigation program to supplement our coating and wrapping. We attempt to apply cathodic protection to all installations currently being added to the system, whether transmission or distribution. This is accomplished by isolating underground piping from aboveground installations and then by applying cathodic protection to the lines in the form of magnesium anodes with the proper backfill material. City gate stations, district regulator stations, etc., are usually designed with a pair of insulated flanges at the outlet end, and an insulated coupling is installed in each new domestic meter loop. Industrial meter settings are isolated by the use of insulated flanges or unions.

The isolation and protection of older parts of the system not originally under cathodic protection is partially "catch-up" and partially corrective maintenance, which was mentioned earlier.

By catch-up we mean such things as the installation of insulated couplings in existing meter loops, either as routine or when a meter is changed. Since this phase of catch-up is done by operating personnel in the various town plants, a selling job is sometimes required to emphasize the importance of installing the couplings.

The corrective maintenance phase of the cathodic protection program involves the isolation and protection of hot spots that have developed in older, originally unprotected parts of the system. All leaks repaired and reported are posted on maps of the distribution system. When an area shows a number of leaks, a section of the system will be isolated by the installation of insulated couplings, which, with the aid of magnesium anodes, helps reduce the rate of corrosion leak incidence until lines can be replaced. In many cases this procedure brings the section under effective enough control so that replacement of lines is delayed indefinitely.

Mr. George is vice president in charge of operations at Houston Natural.

Houston — a major problem

The large, sprawling area occupied by Houston and the bordering municipalities presents a major problem, insofar as leakage is concerned. Other gas companies also serve this area. Hundreds of streets have gas lines that belong to at least two different gas companies. Sometimes these gas lines are just a few inches apart, and when a leak occurs in one of these lines it is somewhat difficult to ascertain whose line is leaking before uncovering the pipe. However, this problem has been solved to a certain extent by the two major companies in Houston using separate and distinct malodorants.

Five leak repair crews, consisting of one foreman and two helpers, repair all leaks found in the Houston area. One of these crews devotes all of its time to repairing lines in the areas in which we know the lines are in the worst condition. When it finishes in one area it is moved to another. This crew may spend several months in one area. All services and mains are tested for leaks, usually with a bar. Manholes and storm sewer catch basins are tested with an explosimeter.

The other four crews in the Houston area are kept busy repairing leaks reported by our customers, our employees, and the other gas companies. When a leak report is received a leak repair order is issued. This order is dispatched to one of the leak repair crews. All of these crews have radios, so the majority of these leak repair orders are dispatched by radio. When a leak is repaired the foreman of the crew fills out a card called a "Leak Repair Report." He indicates on the card the type of leak, the kind of soil in contact with the pipe, the condition of the soil, the condition of the pipe coating, the condition of the pipe surface, and the method of repair. Most of the leaks are repaired by the use of leak clamps. Various types of clamps are used, depending upon the size of the pipe, the size of the hole in the pipe, the number of holes in the pipe, and the gas pressure in the line. After the clamp is installed a thorough doping job is performed. The clamp and the adjacent pipe are covered with hot asphalt com-

H.N.G. Specification 1

1. Mechanically clean the pipe.
2. Apply one flood coat of pipeline primer.
3. Apply two flood coats of asphalt base pipeline enamel (total thickness about 3/32 in.).
4. Spirally apply one wrap of 15-lb asbestos pipeline felt.
5. Spirally apply one outer wrap of kraft paper.
6. Check for holidays in coating by visual inspection and/or by running holiday detector.

H.N.G. Specification 2

1. Mechanically clean the pipe.
2. Apply one flood coat of pipeline primer.
3. Apply two flood coats of coal tar base pipeline enamel.
4. Spirally apply one wrap of Fiberglas or other glass wrap material.
5. Apply one flood coat of coal tar base pipeline enamel (total thickness of enamel about 4/32 in.).
6. Spirally apply one wrap of 15-lb asbestos pipeline felt.
7. Spirally apply one outerwrap of kraft paper.
8. Check for holidays in coating by visual inspection and/or by running holiday detector.

Sectionalizing valve (left) being installed during maintenance operations. The 12-in. valve is tied in with a Dresser coupling to eliminate alignment problems, and to provide limited flexibility needed to combat soil compaction and stress. Bolstering and maintaining cathodic protection applied to distribution network is an important part of a sound maintenance program **(right)**. Here, technicians are installing a 52-lb magnesium anode on a 12-in. loop line in the Houston distribution system.

pound and thoroughly wrapped with pipeline felt.

The "Roving Crew"

Outside of Houston, and in addition to the construction crew working in each district, there is a specialized roving crew that does nothing but plant maintenance work. This crew consists of a foreman, two sub-foremen who double as welders, a timekeeper and 10 to 15 laborers. The crew is equipped with one large mainline truck, especially built to do heavy work and to carry sizable quantities of special fittings, leak clamps and various other equipment needed in repairing mains and services. Also, each sub-foreman has especially built trucks with which to carry both electric and acetylene welding rigs. There are two other small pick-up trucks for general use.

Before the roving crew is sent into a town, studies are made from reports furnished by the measurement department to determine the percentage of gas being lost by leakage. The local district manager is notified in advance, a study is then made of the area and the town system divided into sections.

A "bar test crew," working ahead of the repairmen, bar test the designated area by probing down to the gas line. When in an open space, they test for leaks by firing matches; when in close quarters, new buildings or other hazardous areas, an explosimeter is used. Testing for leakage and needed repair is therefore easier in the small town areas because mains are usually located beneath unpaved alleys and streets. For this reason mains are more accessible and there is less danger from traffic.

The presence of dead vegetation is noted and relied on by our company in its search for leaks also. Suspicious-looking dead spots over our lines are tested thoroughly by our crews. All company field employees are instructed to report these dead grass and vegetation spots.

When to replace pipe?

There are many factors that must be considered before the decision is made to replace pipe. Usually, if pipe has rusted out because of faulty wrapping, a section may be replaced or repaired by clamp. However, if the damaged pipe is near a filling station, school, or other hazardous location and is difficult to reach, the foreman of the maintenance crew decides whether it should be replaced.

When a maintenance crew is sent into a town, its time spent in general repair is charged to maintenance; however, when a section of main or service line is replaced, an order and job number is then assigned by the engineering department. The crew foreman indicates on the completed order the exact location where pipe was removed, any changes in location, the date and the working time of all men. This work order is then sent to our plant accounting department for recording and is then sent back to the engineering department where this information is posted on control maps.

Practically all that has been said about maintenance so far has concerned protection of the underground piping system. And although pipe in the ground represents the larger part of our investment, that does not make any less important the proper maintenance of aboveground installations.

Maintenance of station equipment and buildings is relatively simple in principle. The obvious requirements of painting, etc., are taken care of as necessary. All aboveground equipment such as piping, regulators, valves, headers, and the like, is painted with a primer coat and aluminum paint. In city gate stations there is often a sharp pressure reduction with consequent cooling of the gas from the transmission line, and since the atmospheric dew point on the Gulf Coast is often low, there is a good deal of "sweating" or condensation on some of the piping in these stations. This makes it important to have an effective paint job on equipment before it is put in service, and subsequent painting can often be done only with the station bypassed. This sweating is kept in mind when a building is selected. Adequate provision for ventilation is obtained by specifying the desired combination of roof ventilators and/or gable, wall, or lower door panel louvers. In addition to painting and ventilation, a design feature mentioned earlier is important to maintenance. This is the insulated joint, usually a pair of insulated flanges, installed on the station outlet.

Certain records are used to supplement the maintenance program. Measurement maintains a continuous record of unaccounted-for-gas in each town plant and plots this data as "percentage unaccounted for" on graphs which can be used to tell at a glance what the leakage trend is in any town plant. Thus these records and graphs are of assistance in determining if a distribution system should be worked over by the leak repair crew.

The other record that is used in a similar way is the leak repair report, which is initiated by both the five regular leak crews operating in Houston and by the special roving crew operating throughout the rest of the system.

These crews complete a report on each leak located and repaired and send these reports to the engineering department. In the engineering department, the locations of all such repaired leaks are posted on maps in red ink, and over a period of time a high incidence of leaks in a particular area will show up on the map. These are the hot spots referred to earlier, and usually are given special attention by the corrosion section. It should be pointed out that neither the record of unaccounted-for-gas nor the leak repair reports are used alone to determine when large-scale repairs or replacement should be performed in a particular section, but these records are considered together with other factors in determining when such repairs or replacements should be made. ■

Part 4 in a Series

The New Gas Transmission and Distribution Piping Code

ASA—B31—SECTION 8

A background discussion by **FRED A. HOUGH**

Chapter 3. Piping and Fabrication

CHAPTER 3 of the 1955 edition of the ASA Code B 31.1 Section 8 Gas Transmission and Distribution Piping carries the title, "Piping System Components and Fabrication Details." The general content of this chapter and its purpose can best be indicated by quoting from the code. "The purpose of this chapter is to provide a set of standards for piping systems covering (1) specifications for and selection of all items and accessories entering into the piping system other than the pipe itself; (2) acceptable methods of making branch connections; (3) provisions to be made to care for the effects of temperature changes; (4) approved methods for support and anchorage of piping systems, both exposed and buried."

Chapter 3, (and Chapter 2 on welding discussed in our March article), was developed by a sub group under the Chairmanship of F.S.G. Williams who is manager of engineering standards for Taylor Forge and Pipe Works.*

The basic principle upon which Chapter 3 is based is stated in Paragraph 831 as follows, "All components of piping systems including valves, flanges, fittings, headers, special assemblies, etc., shall be designed to withstand operating pressure and other specified loadings with unit stresses not in excess of those permitted for comparable material in pipe in the same location and type of service."

While this is a comparatively simple statement, it is not always simple to comply with it. This Chapter does not deal with simple cylindrical pipe shapes, but with more complex shapes. Furthermore, the valves, fittings, branch connections, etc. are usually subjected to so-called secondary stresses (stresses other than those produced by internal fluid pressure) which may be of more importance than the hoop stress resulting from internal fluid pressure. In many cases, the secondary stresses cannot be accurately calculated. These factors all require that careful engineering be applied.

The studies made by Subcommittee 8 of transmission facilities failures indicated that the industry has from time to time had difficulty with valves, fittings, branch connections, etc. Much of this difficulty arose from the use of items that have been superseded by welded construction and are for the most part obsolete. However, the experience of committee members and the studies made by the committee indicate that "modern" all welded construction involving both field fabricated fittings and reinforcements, and manufactured fittings and reinforcements, have caused sufficient trouble to indicate that there is need for improvements in design, fabrication techniques, and testing.

Branch connections

To design and build a field-fabricated branch connection with a large-diameter side outlet for a pipeline to be stressed to 72% of the specified minimum yield strength of the pipe and not have stress levels at the connection exceeding this 72% value in places is not easy, and difficulties encountered with branch connections indicate that in many cases stress levels around such connections exceed safe values. When a sufficient amount of reinforcement is provided for branch connections, the stress level in the crotch can be held down to acceptable values. However, when this reinforcement is a saddle or pad, numerous tests indicate that a concentration of stress occurs at the points where tangents to the outside circumference of the pad are paralled to the axis of the header.

In these two regions the stresses resulting from the tendency of the pipe to bend around the edges of the reinforcement are directly additive to the hoop stress. Consequently, if the hoop stress in the mainline pipe is at 72% of the specified yield, a branch connection of this type will produce localized stresses in excess of the limit set by the code.

The code describes or recommends a number of things which if properly done will eliminate this branch connection difficulty. In the first place, the code requires that heavier-wall header pipe be used in those locations where branch connections are most frequently required — specifically, at compressor stations and in mainline fabricated assemblies such as those at mainline valves. In the latter case, the maximum hoop stress permissible in the mainline pipe is 60% of the specified yield strength of the header pipe, and in the case of compressor stations the maximum permissible hoop stress is 50% of the specified minimum yield strength of the header pipe. In the second place,

*The gas industry has benefited greatly from the time and effort that Mr. Williams has devoted to the development of Section 8, both by his contributions of engineering to Chapters 2 and 3 and by his assistance and guidance as chairman of the Pressure Piping Code Committee B31 in the organization and direction of Subcommittee 8. Mr. Williams was ably assisted in the development of Chapter 3 by Arthur McCuchan of Tube Turns, E. O. Dixon of Ladish, W. P. Kliment of Crane Co., L. W. Kattelle of Walworth Co., and by a number of pipeline engineers from the membership of Subcommittee 8 who have had experience in the design, construction, and operation of compressor station piping and other complex piping connected with gas transmission and distribution facilities.

forged tees or full encirclement type reinforcements are recommended whenever the ratio of the design hoop stress to the minimum specified yield stress in the header exceeds 50% and the diameter of the branch connection exceeds 25% of the diameter of the header.

Two types of full encirclement reinforcement are approved by the code. One is designed so that the branch connection can be welded to the reinforcement and does not have to be welded to the header pipe. The other is designed so that the branch connection must be welded into the header pipe and to the reinforcement. In this latter case, however, the welding of the reinforcement to the header pipe with a fillet weld around the header pipe at the end of the reinforcement is optional.

The problem of preventing serious stress concentrations around branch connections is reduced to some extent if ductile pipe and reinforcing materials are used and a pressure test is put on the piping assembly to a considerably higher pressure than the maximum operating pressure. Under these conditions, yielding will occur at points of important stress concentration during the pressure test and the assembly will assume a shape that tends to smooth out the stress pattern. Thereafter, a greater margin between operating stresses and stresses required to produce failure will exist in highly stressed areas than would have been the case had no yielding occurred.

All members of the committee were in general agreement that ductility is a highly desirable property for pipe in compressor stations and in other locations where complex assemblies must be used and where temperature changes vibration and other causes produce secondary stresses that might cause trouble around branch connections. However, the committee did not succeed in stating a code requirement acceptable to all members of the committee that would give effect to this objective. There is, however, little doubt that compressor station designers have assigned, and will assign in the future, considerable importance to ductility in selecting pipe for use in compressor stations, process plants, and other locations where complex assemblies are necessary.

This discussion of the stress concentrations around the branch connections has thus far dealt only with stress concentrations resulting from the intensification of the hoop stress in the pipe. This is only part of the problem and in many cases the less important part. Many branch connections are subjected to external forces. These are usually the result of relative movement between the header pipe and the equipment or pipeline to which the branch connection leads. Branch connections must be designed to take care of these external forces. The problem can be minimized by taking steps to reduce the external forces. This can be done by providing flexibility in the branch piping sufficient to take care of the relative movements involved or by anchoring the header pipe and everything to which it is connected so that little or no relative movement occurs.

Because of the restraint induced by the soil friction, a point on a long, straight buried pipe that is several hundred feet from the end of the pipe or from a bend in the pipe does not move as a result of changes in temperature of the pipe. A branch connection placed at such a point will consequently not move with changes in temperature, and therefore if the facility to which the branch connects is also firmly anchored no problems arise as a result of relative movement. However, if a branch connection is placed near the end of a straight capped buried pipe, the bearing power of the soil at the end cap will not be sufficient to prevent its longitudinal movement. Thus a movement of several inches may occur as the result of normal changes in temperature. A rigid pipe connection to a facility that does not move or might even have a tendency to move in the opposite direction, is almost certain to cause serious trouble.

The solution here, as has already been mentioned, is either to firmly anchor the pipeline and other facilities involved or to provide flexibility in the inter-connection, which will prevent overstressing of the branch connection on the header pipe. When large diameter pipelines are involved, big anchors presenting a large area to the soil are necessary. Situations of the type under discussion here arise where loop lines of limited length are interconnected to the original pipeline. They also occur sometimes at scraper traps and at mainline connections to compressor stations. The rather large fluctuations in pipeline temperature that occur at the discharge of a compressor station, particularly at those that do not aftercool the gas, sometimes cause trouble. This results from the hot pipeline on the discharge of the station expanding backward into the station and overstressing branch connections or equipment to which it is attached in the station.

It became apparent during the progress of the work of Subcommittee 8 that there is much to be learned regarding secondary stresses in pipelines. Knowledge of the conditions that produce such stresses became increasingly important as we progressed to design practices for the larger diameter pipelines. This led Subcommittee 8 to develop a plan for a secondary stress research program and to recommend the program to the pipeline research committee of the American Gas Association. As a result, an active committee of the American Gas Association is now proceeding with this valuable and much-needed research with the financial backing of that association.

Most of the experimental work is being done at Battelle Memorial Institute. So far, the experimental work has been focused on a study of stresses aorund reinforced branch connections under internal pressure, together with various types of external loads, i.e., forces applied to the branch and acting parallel to the axis of the header, and forces applied to the branch and acting perpendicular to the axes of both the branch and the header.

This program is an extension of work on branch connections instituted several years ago at Battelle by five pipeline companies.

The fitting manufacturers are taking an active interest in this work and have agreed to make their own related research work available to the AGA committee.

Other phases of the secondary stress problem which it is hoped the AGA committee will eventually study are:

1. Stresses resulting from backfill.

2. Stresses resulting from non-uniform bearing on the ditch bottom.

3. Longitudinal stresses in buried pipelines. In view of the fact that buried lines are fully restrained in some places, partially restrained in others, and restrained not at all in others, makes this a much more complex problem than many pipeline engineers realize. The idea that the longitudinal stress in a buried pipeline is ½ the hoop stress is wrong more times than right; and such an answer may be either too high or too low.

4. Stresses resulting from pipe being out-of-round. ■

". . . The gas industry, coal industry, and other industries are actively engaged in research into methods and processes for producing gas from coal. Since we now have proven processes that use oil, butane, etc., an answer to the question as to where the industry will obtain oil, from which to make gas — if and when the natural gas and natural oil reserves can no longer supply its needs — may provide one answer to the future supplies of gas."

Where will New England get its future gas supplies?

By **HALL M. HENRY, Vice President** • NEGEA Service Corp., Cambridge, Mass.

In last month's installment, Mr. Henry presented an analysis of the present situation in gas supply economics among typical New England utilities, some of which are seriously considering turning to modern methods of gas manufacture to replace ever-more-costly natural gas.

He also made it clear why some companies in the area are reluctantly favoring regulation of producers.

In conclusion, the author took note of the attitude of the financial people, who (he said) "are tying our economic well-being to the available supplies of natural gas." He quoted a life insurance executive to the effect that "the insurance companies believe that the improved financial condition of gas distribution companies is almost wholly due to the introduction of natural gas"; and that, furthermore, since the same insurance companies are not convinced that "the wholesale substitution of high-Btu oil gas for pipeline gas at a cost that will maintain the competitive position of gas in the local market areas" is possible, they require a substantial sinking fund to offset the "depletion of natural gas supplies available."

Mr. Henry now looks into the future in an attempt to refute the arguments used by the insurance companies to substantiate their position. Where, he asks, will future supplies of gas come from?

IN VIEW of the concern of the financial people, it is well to take stock and see to what extent, if any, there is justification for any worry over the future economic strength of the gas industry.

First: it is obvious that we now have in being several proven processes for producing gas from oil, butane, propane, etc.

Second: the gas industry, coal industry and other industries are actively engaged in research into methods and processes for producing gas from coal. Since we now have proven processes that use oil, butane, etc., an answer to the question as to where the industry will obtain oil, from which to make gas *—if and when the natural gas and natural oil reserves can no longer supply its needs*—may provide one answer to the future supplies of gas.

In thinking of this problem we should also ask where the country will secure its *gasoline needs* when such needs can no longer be secured from oil and natural gas? *If no oil* or *natural gas —then no gasoline!* Fortunately, there already exist processes which are capable of producing gasoline from crude shale oil, which in turn is obtainable from oil shale. The known oil shale reserves are some five times the currently proven oil reserves (see *Table 13*).

Oil shale is found in Ohio, Kentucky, Tennessee, Utah, and Colorado, to mention only a few of the states, with the richest veins being found in Colorado and Utah.

Again — fortunately — there is avail-

Adapted from a talk presented to the NEGA operating division, Jan. 18, 1955.

TABLE 13. Known sources of liquid hydrocarbons in the U. S.

(Units 1,000 Trillion BTU's)	
Oil	112
Natural Gas	100
Oil Shale	514
Tar Sands (Canada)	560
Coal	69,000

able an economic study[1] of the cost of mining and processing oil shale and crude shale oil, and the projected costs of delivering the crude shale oil or the refined products to the Pacific Coast and by inference as far east as Chicago and St. Louis.

It is fortuitous *but not essential*, as will be shown later, that the answer to where we will get gasoline could also be the answer to where we will get oil or gas when neither of these can be obtained from natural gas or natural oil wells.

It is also a fortunate coincidence that in supplying the *current* gasoline needs, say of New England, from oil shale, *there would be produced gas and oil as a byproduct in sufficient amount to more than supply the New Eigland gas demands not only for the past 12 months but those estimated for 1959.*

1 "Synthetic Liquid Fuels" by "United States Department of the Interior 1952, Annual Report of the Secretary for 1951, Part II—Oil from Oil Shale, Bureau of Mines Report of Investigations 4866."

Table 14 shows the products available and the assigned values for an oil shale processing plant and a crude shale oil refining plant with a daily crude shale oil refining capacity of 250,000 bbl per day.

Using the data in *Table 14*, we find the products in *Table 15* will be available from a crude shale oil refining plant, *sized to produce New England's average daily gasoline demands for the year 1953.*

Table 15 clearly shows that with thermal refining there would be *more than enough* gas and oil from which to produce gas to meet the current and projected 1959 gas demands in New England. If mild hydrogention is used, the available gas and oil would be more than ample to meet the 1953 gas demands but would be some 40 billion Btu shy of the projected 1959 gas demands. However, it is to be expected that gasoline consumption will increase, and if this is only 15%, then in providing the additional gasoline needs, sufficient byproduct gas and oil would be available even from a mild hydrogenation plant. However, in studying the gasoline demands in relation to gas demands, and when considering the production capacity of the shale oil refinery when operated thermal and when operated with mild hydrogenation, we find that mild hydrogenation gives a greater gasoline production and less gaseous materials, and thermal refining just the reverse. Thus it would seem that a plant operating to give *maximum* gasoline yields in *summer* with *low* gas yields, when gasoline usage is greatest and gas usage is lowest, plus operating to do the reverse in winter when gasoline demands are lowest but gas demands largest, would give the best overall economic operation. Hence, by operating mild hydrogenation in summer and thermal refining in winter there should be produced more than enough gas and raw materials for our New England gas needs.

TABLE 14. Products available and assigned values for an oil shale processing plant and a crude shale oil refining plant.

250,000 Bbl./Day Refining Plant

Gas BTU's Available from Production of Crude Shale Oil:

Fuel Gas	7,120 MCF (1060 BTU) =	7,547 MM BTU	@	14.2 ¢/MM BTU
" "	865,000 " (80 BTU) =	69,200 " "	@	11.1 ¢/ " "
	Total	76,747 " "		11.4 ¢/ " "

Thermal Refining of Crude Shale Oil:

Regular Gasolene	103,600 Bbls./Day	12¢/gal.
No. 6 Oil	73,790 " "	$1.70/bbl.

Fuel Gas	62,750 MCF (1,300 BTU) =	81,575 MM BTU	@	14¢/MM BTU
Propane	13,860 BBLS. @ 2.5¢/gal. =	52,330 " "	@	27.7¢ " "
Butane	2,160 " @ 6¢/gal. =	8,527 " "	@	63.8¢ " "
	Total Gas	142,432 MM BTU	@	22.0¢ " "

Mild Hydrogenation:

Premium Gasolene	63,400 BBLS./Day	13¢/gal.
Regular Gasolene	63,400 " "	12¢/gal.
Diesel Fuel	62,300 " "	9¢/gal.

Propane	2,138 bbls.	@	2.5¢/gal.	=	8,069 MM BTU	@ 27.7¢/MM BTU
Butane	6,780 "	@	6¢/gal.	=	26,781 " "	@ 63.8¢ " "
	Total				34,850 MM BTU	@ 55.4¢/MM BTU

What of costs of gas from crude shale oil refineries?

Using the cost elements developed in the report on "Oil from Oil Shale" and as shown in *Table 15*, we find the gas requirements for New England, when supplied from a crude shale oil refinery, would have the values shown in *Table 16*. In considering these costs it should be kept in mind that the cost figures include the carrying charges on an oil line from Rifle, Colo. (the assumed location of the oil shale), to the West coast, or say, Chicago or St. Louis. Thus, the costs of the gas are those *at a refinery in one of these locations.*

To this cost would have to be added the transportation costs by pipeline from the refinery at St. Louis or Chicago, a distance of some 1200 miles. The gas could be transported at a cost of not more than 20 cents to 25 cents/Mcf, thus making the gas byproduct worth 14.9 cents + 25 cents or 39.9 cents per Mcf in New England. This would be the projected cost predicated on a refinery located at St. Louis and assuming new pipelines. It would seem, however, that existing gas transmission lines could be used to transport the gas, and this would only require a tie-in pipeline from these existing pipelines into the refinery. Thus, it could be expected that by the time it is necessary to resort to other means of getting a supply of gas, the existing transmission

pipeline would have been largely depreciated, so transportation costs would be less than at present.

Then, of course, there is the possibility that it would be more economical to transport the crude shale oil to refineries farther east (since it is cheaper to transport oil Btu's by pipeline than gas Btu's). It is not inconceivable that the crude shale oil could be transported into New England and refined here.

Gas company could use crude shale oil

There is the further possibility that it would be more economical for the gas industry to take the crude shale oil and convert it into gas, tar, light oil, etc.

It has been estimated that the crude shale oil could be laid down in New England for around $2.50/bbl using the same figure as developed in the report of the Bureau of Mines. It has further been found by test on shale oil at the Institute of Gas Technology that crude shale oil is satisfactory for gas making. It has about the same properties as a reduced crude, or the New England enrichment oil which certain New England gas companies have used for some 15 years.

Cost of gas from crude shale oil

If we can get crude shale oil delivered for $2.50 per barrel, then the cost of 1000-Btu gas would be around 60 cents to 65 cents per Mcf. This makes no allowance for any increase in byproduct credits over those existing today. It would seem that by the time it is necessary to obtain gasoline, lubricating oil, and gas from oil shale or coal, the value of tar and light oils will have increased substantially, making it possible to credit a larger sum for residuals, and thereby reducing the holder cost of gas. There has been some fear expressed that with gas companies producing all of their gas, the byproduct value of tar and light oil might be less rather than more. It would seem that this type of thinking fails to take into account the large volumes of asphalt, light oil, etc., coming out of natural oil refineries which will no longer be available if there is no oil from natural oil reserves. Hence, it is conceivable that tar and light oil credits could be much greater than at present, rather than less.

Gas from oil shale

Since there is a proven method for processing oil shale to produce crude shale oil, and since in processing the oil shale, some gas is produced, there would seem to be an excellent possibility for the gas industry to use oil shale and process it directly to a gas, taking the vapors containing the crude shale oil and gases, and by thermal cracking and autohydrogenation produce a suitable pipeline gas. It is believed that this would prove particularly attractive in processing the oil shales of Ohio, Kentucky, etc., where the oil in the shale is about half that in Colorado and Utah. Converting the products from the oil shale plant directly into pipeline gas could conceivably reduce the cost of the gas produced over, say, producing the crude shale oil, and then converting it into gas using the TPC, Hall or autohydrogasification or pressure gasification process.

Another possibility would be to produce a low-Btu gas from coal, which can be done by proven methods which are economical, and mix this low-Btu gas with high-Btu gases of 1300 to 3000 Btu produced at the crude shale oil refinery. This would avoid the cost of upgrading the low-Btu gas by methanation, etc., and should result in a low cost gas.

It is evident that oil shale could provide a source of gas and, based on the Bureau of Mines study, at a cost comparable to present day costs in New England.

Should coal processes be found to be the more economical means of supplying the future gasoline, diesel, and lubricating oil needs, then here, too, since in certain processes gas is a byproduct, it could be used to substitute for the dwindling natural gas supplies.

The gas industry is not dependent on the byproduct gas that will be available from processes that may be used to produce gasoline.

The techniques of producing a high-Btu gas from coal are known, thus assuring gas supplies as long as the coal reserves hold out, and these reserves do represent the largest reserves of potential gas-making materials.

Production of synthesis gas from coal

A pressure coal gasification pilot plant unit was built and first tests completed in 1949 by the Institute of Gas Technology. Tests have been made on the following coals:

- Kentucky high volatile B bituminous coal
- Illinois high volatile C bituminous coal
- Pittsburgh Seam Federal No. 1 mine coking coal (91% ash 2120° F ash fusion temperature)
- Ameagle No. 70 Mine (No. 2 gas) Eagle Seam, West Virginia coking coal (7.74% ash 2720° F ash fusion temperature)

Satisfactory results have been obtained on these various coals thereby demonstrating the flexibility of this type of gasification unit. A series of high capacity tests at coal feeds of 1000 to 1500 lbs/hour were made on Illinois high volatile C bituminous coal.

Projected costs

Thus there is in being a pilot plant unit capable of processing a variety of

TABLE 15. Products available from crude shale oil refining plant sized to produce New England's 1953 daily gasoline demands.

	Thermal	Mild Hydrogenation
Barrels/Day required to produce gasolene needs (NE)	375 000	306 000
Gasolene produced	153 750 bbls.	153 000 bbls.
Gasolene used/ave./day(NE)	153 000 bbls.	153 000 bbls.
BY PRODUCTS:		
Fuel Gas -	122 362 MM Btu	None
Propane Gas -	78 495 MM Btu	10 188 MM Btu
Butane -	12 790 MM Btu	32 780 MM Btu
No. 6 Oil (16.8 gal/MCF) =	276 000 MM Btu	
Diesel Oil (14 gal/MCF) =		228 000 MM Btu
Total	489 647 MM Btu	270 968 MM Btu
GAS REQUIREMENTS (NE)		
Year 1953	131 500 MM Btu	
Year 1959 (per FPC hearing)	310 000 MM Btu	

New England's future ... What are the economics of producing synthesis gas from coal?

coals to produce a *synthesis gas*. This unit has been operated over a long-enough period to have clearly demonstrated its economic feasibility. Using the data thus far developed plus certain new concepts and projecting plant investment and operating costs for a complete plant capable of producing a 950 Btu to 980 Btu/cu ft gas, the Institute of Gas Technology has established probable investment and operating cost figures. For comparison there is shown a similar estimate prepared by Blaw Knox Co. *(Table 17.)*

If the IGT concepts can become a reality, the gas industry will have a low-cost high-Btu gas from coal and its economical future would not be dependent on natural gas, or oil shale.

The primary differences between the IGT and the Blaw Knox figures are due to the method of producing a high-Btu gas from coal. The Blaw Knox cost figures are based on the Lurgi process whereas IGT proposes the dilute phase process. This latter process did not appear to be as promising as the Lurgi because of the larger volumes of oxygen required (over twice as much) in the original studies; however, based on new concepts, the oxygen requirements have been reduced by some 40% and furthermore, the compression and steam requirements will be obtained by the use of pressure turbines, thus eliminating a costly steam plant. In addition the CO_2 in the final gas is 10% vs. 20% or more than the estimates previously considered, and this has resulted in a lower cost for CO_2 removal. Thus, whereas the Lurgi process may yet produce a low-cost gas, and estimates of 40 cents to 50 cents have been indicated, the dilute phase process seems to be equally adapted to the production of a low-cost pipeline gas from coal.

Pipeline gas from coal: Methanation

A 900-Btu/scf heating value (inert-free basis) has been produced at IGT in small bench-type test units using nickel catalysts, and utilizing a synthesis gas generated in the IGT pressure coal gasifier. Several 50- to 70-hour tests gave practically complete conversion of the synthesis gas. Unfortunately the upper limit of sulfur content of the synthesis gas when using nickel catalysts was extremely low and a satisfactory method of purification will have to be discovered and developed.

It is evident that it is possible to produce a synthesis gas from coal, and equally evident that such a synthesis gas can be elevated to a high Btu gas by methanation. The $64 question remains: What are the *economics*?

Before final answers can be given to this, considerable study, research and development must be done. In an attempt to get the answers, the gas production research committee is proposing the following research in 1955 on catalytic methanation.

(a) Continuing study in the development of better catalysts.

(b) Study of purification methods for synthesis gas.

(c) A scale-up of methanation operations to larger sizes of fixed bed or fluid bed units.

In studying the various reports, it seems that substantial progress is now being made in the development of better catalysts. Runs as long as 252 hours have been made on a sulfur-free synthesis gas with complete conversion at 700-750°F using a 16% nickel Kieselguhr catalyst (recommended by British Fuel Research Board).

A combination 6% CO-6% Na on Kieselguhr looks very promising at pressures of 300 psi and 750°, giving *complete conversion* after 100 hours of operation. Operation at 270 psi has been started and looks very good at 300 hours.

There seem to be two schools of thought as to whether a fixed bed or fluid bed unit should be used. The catalysts' requirements differ for each. Tests to be conducted on the research program at IGT will attempt to determine the limitation and advantages of each.

One of the important, if not the most important, factors in the economics of producing a high Btu gas from a synthesis gas is that of sulfur removal. There are some new developments in connection with sulfur removal and a commercial unit employing the Rectisol process, which seems most promising, is being built in South Africa. An aggressive research program on sulfur removal seems imperative.

The Pittsburgh Consolidated Coal Co. has been active in studying, investigating and testing various methods for the production of a pipeline gas from coal. A recent study was submitted to the AGA operations research committee by Pittsburgh Consolidated, and certain statements made by Joseph Pursglove Jr., vice president, research and development, are quoted below:

"In the course of their work on the subject, our people have prepared estimates of the cost of producing 925-Btu gas at 1200 psig in a base load plant to be located at mine mouths in northern West Virginia. These estimates were prepared to define the cost of gas as it might be produced by conventional methods which now exist or are in a partially developed status. The figures were made available to the AGA on a limited basis, to assist the subcommittee on pipeline gas from coal in evaluating the attractiveness of several competing methods of manufacture.

"Assuming coal at $4 per ton, 14.5% capital charges on the plant investment, and no byproduct credits, these estimates show that high-Btu gas might cost 80 cents to 90 cents MMBtu, f.o.b. plant, *based on*

TABLE 16. Cost of gas to meet 1953 gas demands, if obtained from crude shale oil refining plant.

(Using the volumes of gas available from the refining plant sized to the New England gasolene demands we find to supply 131, 500 MM Btu/Day there is available fuel gas and propane at the following values:)

From Fuel Gas	122, 362 MM Btu @ 14¢/MM Btu
From Propane Gas	78, 495 MM Btu @ 27.7¢/MM Btu
Total	200, 857 MM Btu

Hence if we use the 122, 362 MM Btu of fuel gas this leaves only (131, 500 - 122, 362) = 9, 138 MM Btu to be supplied from propane. Hence the cost of the gas at the refinery would be:

122, 362 MM Btu @ 14¢ =	17, 130. 68
9, 138 MM Btu @ 27. 7¢ =	2, 531. 22
	19, 661. 90

Hence average cost of only 14. 9¢ MM Btu.

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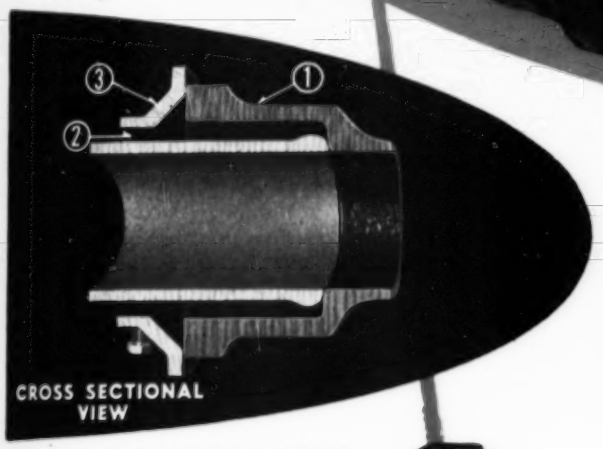

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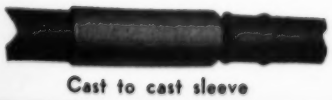

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existing technology. No significant differences in economic attractiveness exist between dust gasification, fluidized systems, or Lurgi units on this basis of evaluation. However, we have done sufficient small-scale work on improvements to the Lurgi process to convince ourselves that limited development work will reduce gas costs by this route to 70 cents to 75 cents/MM Btu, again with no byproduct credits. If a realistic allowance is made for the future worth of byproduct tar, the gas cost via Lurgi would reduce to a figure of about 65 cents/MM Btu. This, we believe, is the practical floor under synthetic high-Btu gas costs unless radically new processes for gas manufacture are developed.

"Small scale work on new processes conceived by our people indicates that high-Btu gas may ultimately be made at a significantly lower cost, perhaps 45 cents to 55 cents/MM Btu, using a completely nonconventional gasification route. Obviously, however, these costs cannot be projected with precision because they anticipate the outcome of an extensive development program which must be carried out prior to commercial plant construction."

TABLE 17. Probable investment and operating cost figures to produce high-Btu gas from coal.

	Investment per MM Btu Per Day Capacity	
	IGT	Blaw Knox
Oxygen Plant	$144.21	$103.00
Gasification	53.68	54.00
Water Gas Shift	4.21	0
Sulphur + CO_2 Removal	-	44.00
Methanation	21.05	23.00
Compression	19.68	7.00
Process Equip.	242.84	231.00
Utilities and Off Sites	50.10	205.00
Plant Costs	292.94	436.00
Operating Capital	15.79	45.00
Total Capital Reqt.	308.73	481.00
Divide by .95 IGT		

Operating Costs Per MM Btu		
Direct Costs	IGT	Blaw Knox
Labor & Super.	1.26¢	1.20¢
Maintenance	2.32¢	4.80¢
Catalyst	1.33¢	2.10¢
Chemicals	1.26¢	0.40¢
Misc. Supplies	0.84¢	0.00¢
Prop. taxes	2.14¢	1.50¢
Indirect Overhead	.95	0.90¢
Sub total	10.10	10.90¢
Capital Charges		
Dep. Ins. etc.	4.27¢	12.50¢
Tax & Profit	5.55¢	8.80¢
Sub total	9.82¢	21.30¢
Fuel Costs:		
Discs @$9.25	-	45.60¢
Stack @$4.00	24.31¢	-
Water	1.05¢	
Sub total	25.36¢	45.60¢
Total Cost	45.28¢	86.50¢

This quotation holds out a hope and a challenge to the gas industry; a hope that through research it may be possible to produce from coal a pipeline gas at a cost (45 cents-55 cents/MM Btu) that would remove any dependence of the gas industry for its economic well-being on natural gas supplies, or an by-product gas, however promising these are; a challenge as to whether we will provide the necessary research funds to bring this hope into reality.

It is certain that the 45-cent to 55-cent production-cost figure cannot be realized *until* and *unless* we make available the research dollars it will require to check into the fundamentals and techniques such a production cost figure entails.

Unless we *immediately* (not 10, not 5 years from now) show real promise of securing a reasonably low-cost gas from coal, we may have to look forward to a continuation of the burdensome restrictions now being imposed on new bond issues of distributing gas companies. If for no other reason, it would seem that we should insist that research on gas from coal be pushed to a successful conclusion. This, despite the fact that many of us have thought that with all of the new and potential new discoveries of gas and oil, plus the fact that if oil and natural gas are no longer available, then gasoline supplies must come from oil shale or tar sands or coal, and the fact that oil shale techniques are already developed to a point to assure gas or raw materials from which to make gas, we could go along at a moderate research pace.

We must advance the date of successful completion of our coal gas research to the point of an actual demonstration plant if we want to eliminate the heavy sinking-fund requirements now being imposed.

Conclusions

(1) We now have available and in use gas processes that can produce a substitute for natural gas, and, for most of the New England gas companies, at costs equal to or less than the cost of natural gas plus standby and peak load gas.

(2) When natural gas or oil is no longer available, the New England gas companies can secure a supply of gas or raw materials from plants which will be required for the production of the New England states' gasoline needs.

(3) It would seem that if there is no natural gas or oil, then the gas industry will be confronted with competition not from oil, but from coal and electricity. Hence the talk about the gas industry not being able to manufacture gas at a cost that will enable it to compete with oil seems groundless.

(4) The currently known natural gas reserves will have to be withdrawn over a longer period than the 20-year period established as the mathematical number that the certificated use divided into the dedicated reserves must equal. Therefore, long before natural gas is exhausted it will be necessary to supplement the natural gas supply with manufactured gas (unless new reserves are found) and hence the cost of producing gas will be gradually (not violently) integrated into the economics of the gas industry.

(5) Anyone familiar with the advances in gas technology knows that future production of gas from *coal* must be at the mines, so current plants will be required, as they are now, for standby and peak shaving.

(6) While at present it does not appear to some of us that gas production costs using byproducts from crude shale oil or coal will result in materially higher gas costs than now prevail here in New England, it would seem that, with the rising standard of living, by the time we will have to produce gas, the consumer will be able to stand some increase in gas costs. As a matter of record, there is a company in New England which had a 20% to 25% saturation of gas heating at rates 15% to 25% higher than present. Its earnings were satisfactory although gas holder costs were some 30 cents to 40 cents per Mcf higher than present.

(7) While it would appear in view of the above that the financial people should be optimistic over the future of gas and should be willing to remove the heavy sinking-fund requirements, unless and until they will do so, it seems that we should put more funds and more effort into research on gas from coal so as to have a process in being that will give the financial people the assurance they seek.

(8) We should have a competent committee sponsor an economic analysis of the gas industry to try to assemble facts that could be helpful in correcting the present financial attitude. ■

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GAS exclusive

Accidents are committed*

By WILLIAM M. HENDERSON

*A conclusion supported by observations during a 50-year career in the gas industry

AS THE gas industry turns more and more of its attention to the ever-present problem of accidents, emphasis is laid upon the adoption of safe working procedures and safety devices to protect workmen from their follies. This built-in safety makes for safe working conditions and subtly serves as notice to workers that the company itself is opposed to accidents.

But it does not make the *man* accident-proof.

Violation of standards

Rules and regulations, like traffic laws, are not preventives—unless enforced. Accidents are the result of the violation of established standards for work procedure.

Accident control is definitely a production function. The responsibility for enforcement of safe working practices must be placed upon members of the supervisory staff and they must be so informed. They have a vital role to play in accident prevention just as the safety engineering department does.

Essentials of safety

A safety engineering department is an essential if there is to be safety on the job, as safety consciousness must be established before it is begun. The safety department serves in an advisory capacity to management and has the responsibility—

1. To promote safety, stimulate employee interest, and participate in accident control.

2. To investigate accidents, report potential hazards, and plan correct action.

3. Prepare for release by management a statement on the position of the company with respect to safety practice. This should give complete details on the exposure, what has been done to incorporate safety in all operations, and what is expected from the employees.

4. Prepare a standard practice manual on safe working on job operations and follow up by a training course for work supervisors, to be directed by a staff member of the safety department.

Work supervisors in turn should be charged with the task of instructing the workmen, for if the supervisor is required to teach, he will have to learn. When everybody participates, all will understand that safe working is standard procedure.

On-the-job audits

To maintain standards for safe working, a system of continuous on-the-job audits by a safety engineer, accompanied by a production supervisor, should be established. The supervisor assignment should be placed on a rotation basis. All this procedure establishes the proper environment in which safe working practices will take root.

Lack of standardization of procedures for safe working can be substantiated by a study of accident statistics and re-

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Mr. Henderson, who from 1924 until his retirement in 1950 served as superintendent of gas distribution for the old Los Angeles Gas & Electric Co. and Southern California Gas Co., entered the industry in 1902 as office boy for the president of California Gas & Electric (PG&E's predecessor). Subsequently, he served as superintendent of Sacramento gas works, gas company manager at Colusa and Fresno, and from 1913 to 1924, was assistant gas engineer and distribution engineer for PG&E.

Since his retirement, the former secretary of the PCGA, and for the past several years special emissary for Mueller Co., has been the sparkplug of the southern California chapter of the American Public Works Association, serving as its first president.

ports. The records of accidents should provide the clues to standard needs, and workmen should thereby learn from the mishaps that have occurred to others.

On the job, most personal injuries are the result of human error. In the majority of cases, established methods for doing the job have been violated and these same types of accidents are repeated, as is well illustrated by a survey *(Table 1)* made of injuries occurring among street crews engaged in pipe installations.

"Man" act

As can be seen, each one was a "man" act, probably an occupational disease and apparently contagious. This study also serves to illustrate a weakness of supervision in failing to fully control the action of men.

What stimulates interest in accident prevention is the "box score" on industrial injury ratings in relation to exposure, such as are released by the National Safety Council and the American Gas Association.

The National Safety Council releases yearly a rundown on the experience in the 40 major industries in the U. S. The ratings are based on accident frequency, lost-time accidents per million man hours worked, and accident severity (time off per thousand man hours worked).

Let's compare the record of three utility services—telephone, electric, and gas—and the average for all 40 industries on accident frequency for the year 1953 *(Table 2)*.

The comparison is rather significant. Based on equivalent work hours exposure, the gas industry suffers 10 lost-time accidents before a communication worker experiences one lost-time accident. Maybe such a comparison is open to criticism on the basis of difference in exposure. Before admitting a difference, let's take a peek into the past, when the scoring for disabling injuries was based on 100 employees. For the year 1922 the telephone industry recorded six per 100 employees; the electric utilities, seven per 100. The earliest record of the gas industry (1929) was seven per 100 employees.

A frequency of six and seven per 100 employees, converted to the present base, "disabling injuries per million man hours," gives a rating of approximately 35 and 40, respectively. In each case, substantial improvement is shown.

The communication industry is predominantly the telephone company, operating under standards established by the Bell System. Here is an example of a nationwide industry with one standard, coast to coast. Standard practice is established by job breakdowns and all supervisors attend training courses. Workers, by demonstration, are taught the right way to do things safely.

TABLE 1. Injuries among street crews*

Protective equipment provided but not used (gloves, goggles, toe guards)	10 cases
Improper use of tools	8 cases
Safe working standards disregarded	4 cases
Impatience or impulsive action	3 cases

*Based on a 1948 study of 51 cases of repetitive accidents.

TABLE 2. Record of three utility services

	Frequency Rate (lost time injuries per 1 million man-hours)	Rank (Position in relation to 40 industries rated)
Communications (telephone)	1.22	1st
Average all industry	7.44	8th
Electric utilities	9.43	24th
Gas utilities	12.92	30th

The situation is different within the gas industry in that there is no control authority. However, there is a medium through which accidents in the gas industry are reported, and these experiences should be used as the basis.

It is a quarterly titled "How Injuries to Gasmen Might Be Avoided," published by the accident prevention committee of the American Gas Association. If not cheerful reading, it is quite enlightening.

This is a record of accidents occurring in the industry, including a statement of circumstances, description of accident, resulting injuries and damages, with recommendations on how to prevent recurrence.

Exposure frequency

The gas utility need not suffer an accident to discover what not to do. It is apparent from these quarterly reports that within the industry the exposure frequently is repeated and the consequences are the same, except for degree.

Repetition is bad, particularly when the knowledge of evil experienced by others is available for guidance.

Every gas utility supervisor should receive a copy of this publication.

Let's consider one example of accident exposure that has repeatedly cropped up in these reports—a type of exposure that, with standardization of safe working procedure, might be eliminated. Here is a prime example of how advantage might be taken of past experience in setting up proper standards.

This accident consists of burn injuries sustained by men working in the presence of blowing gas, where a fire started without, in many cases, any apparent source of ignition.

Blowing gas

In another AGA publication, the annual "Review of Fatal Injuries in the Gas Utility Industry," blowing gas too frequently shows up as the cause of death, either from burns or suffocation.

That gas burns is obvious, but the source of ignition is often obscure. Investigation has disclosed static electricity as a possible source. Static would be generated by blowing gas and accumulated when it contacted an insulated object, such as a workman's clothing, when the atmosphere is at a low humidity.

Wherever static is a recognized hazard it will be observed that means are provided for preventing accumulation, either by effective grounding or by maintaining a high humidity atmosphere for drainage.

Static phenomena

The static phenomena needs to be translated to job operations on gas pipes. Gas flowing in a metallic pipe will dissipate static as generated through turbulent flow contact with the grounded pipe wall. But as gas escapes to atmosphere, the gas stream may be heavily charged. When the atmosphere is dry and the humidity low, and the blowing gas contacts a workman, the

AGA's safety expert seconds Mr. Henderson's motion for standardization

THAT standardization is a key to safe operating procedures (as Mr. Henderson points out in the accompanying article) is a concept with which the AGA's own expert, Rauel N. Papich, heartily agrees. Mr. Papich, the AGA's recently appointed safety consultant, made a swing around the country last year, and on the basis of his observations ("I haven't seen every job performed in the gas industry, but by now I have seen a great many of them") has this to say:

"One of the conditions that made a very definite impression was the lack of standardization . . . I sincerely believe that standards should be viewed not as a ceiling, but as a floor on which to build. Standardization is not a handicap to creative ability; on the contrary, problems that have been solved by standards become a matter of routine, thereby freeing the creative abilities for problems still unsolved."

Meaning of standardization

Speaking before a recent safety conference of the New England Gas Association, he cited some examples of what standardization would mean:

"I visited one company where a pig was just being taken out of a pipeline at a trap with only so-called 'normal' safety precautions. The men in this instance were cautioned about smoking and the operation went on.

"In another company, a similar operation called for: (1) No trucks to be within 300 ft of the trap; (2) men on the job were instructed to leave all matches, cigarettes, pipes, etc. at the trucks; (3) precautions were even taken as to the type of clothing worn—nylon, dacron, etc., were prohibited.

"Now, both companies were doing the same operation under the same relative conditions, but the method of operation was completely different. Why? Well, it may be interesting to note that where the safety precautions were rigidly enforced, that particular company lost several men during one of these operations, and as a result, the above safety precautions were incorporated.

Rauel Papich

"Another instance is the use of trenching machines. The company was using its machine with men laying pipe in the trench, and in the course of the operation, the man laying the pipe backed into the machine while it was in operation. As a result of this accident, safety practices in regard to personnel in trenching operations were written and a very effective guard was devised so that this particular type of accident could never happen again.

"This type of information should be available to the rest of the industry as soon as possible after any fatal accident, and if necessary, steps should be taken to protect all gas personnel from any similar experience.

"Standardization should not be viewed as only a safety measure, but I'm sure all of us know that on an industry-wide basis standardization is also an important economy measure. An instance where standardization could be termed economical is in a manufactured gas plant I visited where the company went to a great deal of expense to install explosion-proof lights in the bottom floor of their generator plant. I'm familiar with many of the possible reasons for this situation —insurance coverage costs, state code, etc.—but industry-wide acceptance and establishment of a standard for this particular type of operation might have made this expense unnecessary.

"I found some companies are reluctant to put down job breakdowns in 'black and white.' I have run into such explanations as: 'He's been doing the job for 40 years. He doesn't need to read it.' Well, this may be, but from an accident prevention point of view, it is accepted and economical sound practice to have job breakdowns available for new men to read and for constant review by worker and foreman alike.

Misunderstanding

"This brings to mind an apparent misunderstanding of accident prevention's place in gas operations. I know that this is old stuff, but I was surprised at its acceptance. Safety in all too many instances is a separate company endeavor. They get the job done with an 'as safely as possible' attitude—instead of getting the job done safely. Safety should be part and parcel of every job breakdown. It should be so integral a part of a job that it is accepted as part of it and not as a supplement."

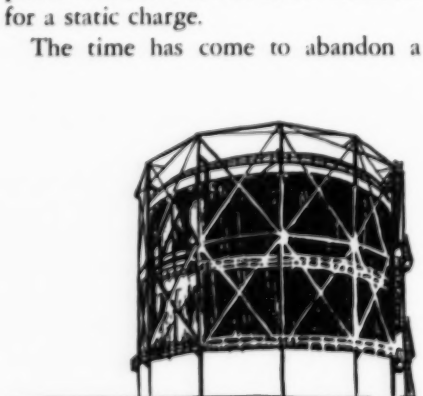
body may accumulate a static charge in a matter of seconds. As the workman makes a ground contact, an arc will jump, providing the source of ignition.

Conditions need to be favorable for static generation and accumulation, but who on the job knows when they are or are not?

The gas industry has in recent years passed through a change of life, the transition from manufactured gas to natural gas. This has been accompanied by a physical change in the product.

Natural gas delivered at transmission line pressure, when reduced to distribution pressure, expands, resulting in a dew point of $\pm$ 0° F. A dry gas, it's a perfect insulator and so an accumulator for a static charge.

The time has come to abandon a traditional practice that allows a workman to be exposed to blowing gas. It is now possible with equipment available to avoid this hazard.



The industry's concern with accident prevention is not only a humanitarian obligation. It must also consider the economies, the means to reduce the mounting costs for insurance premiums, medical costs, legal expense, disability compensation, and other related costs.

Insurance is a bet that you are going to have an accident. The insurance company bets you won't.

The payoff—to win the bet, you have to lose. But effective prevention pays in full. ■

To bring meters to the new central meter shop at Chatham from the districts, carts were designed with three tiers that could be loaded directly on to a covered truck by a hydraulic tail gate, minimizing handling and eliminating the necessity of a ramp or platform for loading and unloading. Meters received at central repair are wheeled into the shop in these carts to the incoming prover where their condition is recorded.

From the carts, the meters are removed and, because of bottom irregularities, are placed on small pallets that carry them smoothly on the conveyors to the sand blast cabinet. All conveyors, except the overhead unit at the paint booth, are graded for gravity flow. Later, two conveyors also carry the meters to the test benches, the meters being first separated as to types.

Sand blasting is something new in meter repair at Union Gas, cleaning being done previously by wire brush and scraper. Liquid cleaning was considered but ruled out in favor of sand blasting. Results to date have been very good both as to quality and time required for cleaning. After blasting, the meter is conveyed to the de-topping benches where the tops are removed and the bolt-up types disassembled.

Union Gas mechanizes its meter repairs

By **GAVIN H. D. MARTIN, Chief Engineer** • Union Gas Co. of Canada Ltd., Chatham, Ontario

METER repairs for the entire system of Union Gas Co. and City Gas Co. of London are now centralized in Chatham in a new building where assembly-line techniques can be employed, with resulting economy of operation.

There are approximately 88,500 active gas meters in the Union system, located in four districts as follows: Windsor, 34,500; Chatham, 20,250; Sarnia, 11,750, and London, 22,000. Since government regulations require that all meters be checked for accuracy at least once in six years, the annual turnover of meters is approximately 14,750 meters per year. When a meter is brought in for proving it is checked externally and internally before being government-tested.

Until recently, this work was done at each of the four company districts where every meter was manhandled from truck to storage, to repair bench, to test bench, to paint bench, and finally to storage. The handling costs were excessive but because of the relatively small number of meters repaired, mechanization could not be justified. Uniformity of cost and quality was difficult to maintain.

Consideration of these factors led to the decision to establish a central meter repair shop and transfer the meters by truck to and from repair. To reassure ourselves that the meters would not suffer in transportation, several meters were carried in the rear trunk of cars for more than 1500 miles and then checked. No detrimental effects being evident, it was decided that the relatively short hauls involved from central repair would not be detrimental.

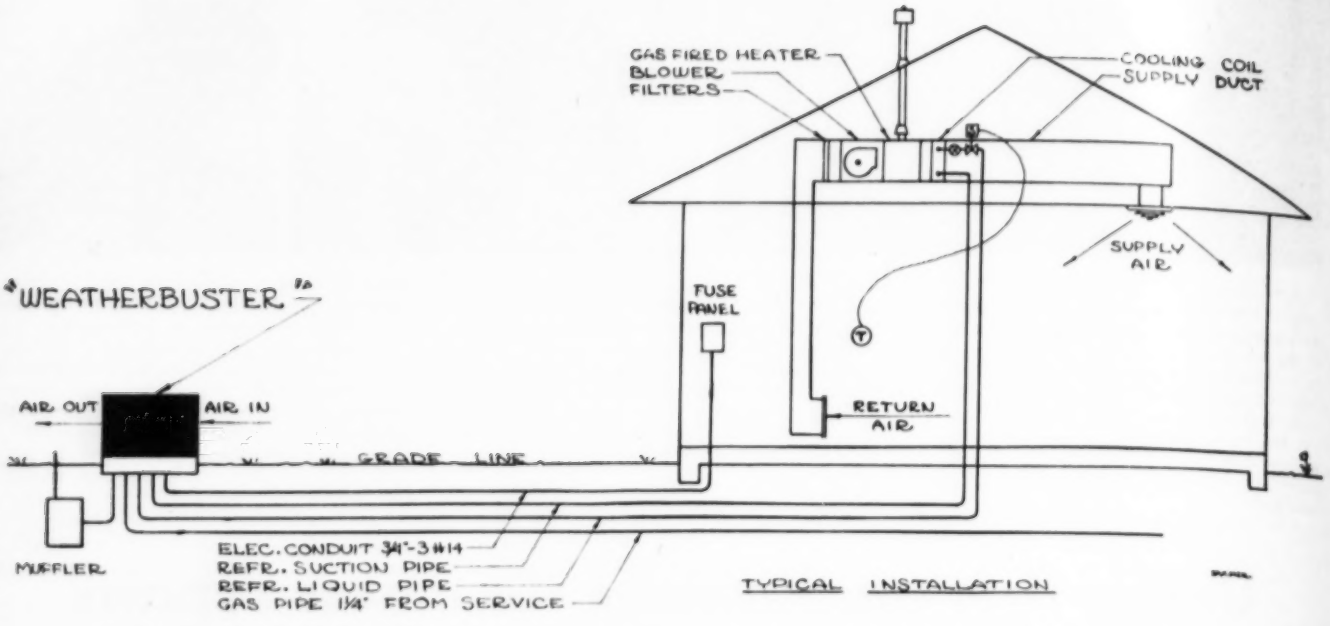
No space at any of the districts was available to house the central repair shop so it was necessary to design and build space to meet requirements. Since there is great diversity of meter types in the Union-City system, ranging from 5- and 10-light tin meters to Emco, Iron Clad, Iron Case, Tobey, and Begwaco bolt-up types, it was decided the greatest time saving device would be conveyors, which would minimize handling, rather than special jigs and other automatic equipment which could handle only a part of the total.

The photos show some of the outstanding features of the new shop. Not illustrated are the testing and proving benches and the record-keeping system.

Following repairs, conveyors carry the meters to the benches, where they are leak-tested at 1 psi, registered on a water column for 10 minutes; then they are proved and tested for low rate of flow by passing a small volume of air through them. A bubble jar, used as an indicator, shows whether the air is flowing at all times. Underwater tests are the final step before meters are sent to the government prover.

Closer control in record-keeping is achieved through the use of IBM tabulating cards, which, when fed through the machine, quickly indicate which meters are due for a test.

The last operation, painting, employs a method not previously used in meter shops. An overhead conveyor carries the meters through an open tank where paint is continuously poured over them. This pouring process is a modification of the dipping method but eliminates the buoyancy problem inherent in submerging tin meters. The rate of the conveyor is timed so that the meters are dry when the cycle is completed. The meters are now ready for shipment.



The Weatherbuster is installed outdoors on a 12-in. concrete slab. The muffler is buried 24 in. below grade to provide extra sound insulating properties. The Weatherbuster is said to be suitable for installation with any well designed new or existing air conditioning system.

Competitive domestic air conditioner uses gas-driven compressor

By **WILLIAM W. CLARK** · Editorial Director

THE gas industry is going to have an economical, efficient, and competitive domestic air conditioning system, using a gas-driven compressor for the cooling cycle to team up with gas heat for the winter cycle. The only question today is "When?"

It may be here already; or it may not come for many tomorrows, depending upon numerous factors.

Two gas-driven compressor-type air conditioners are already going into production, but information available does not indicate whether they are the answer the industry has been seeking. At least two other possibilities exist, but unless sufficient interest is shown by the gas industry they may never be more than simply possibilities.

Just last month, one production model was unveiled by the Wood Electric Co. of Camden, Ark. The second, which "will be put on the market this year," is to be the product of Cobell Industries Inc. of Fort Worth, manufactured to a design of Thomas W. Carraway, thermodynamics engineer.

GAS staff report

"Possibles"

The two "possibles" are the gas turbine-driven compressors already being used on aircraft, one of which is manufactured by AiResearch Manufacturing Co., a division of the Garrett Corp., the other by Solar Aircraft Co. Both of these latter prime movers are now in limited production for the government; their unit costs are very high, their operating ratios admittedly relatively inefficient. Considerable engineering work is required to make them adapable for use in gas all-year air conditioners, and until the existence of a sizeable market is proved to them, it is somewhat doubtful that either of these aircraft companies will proceed with production.

Some of this required interest of gas company officials has already been shown. AiResearch has been contacted by executives of at least two of the nation's largest gas utilities. Engineers of the company are already investigating the design problems, two of the foremost being cost and sound muffling. Available information indicates that this company has taken a quick look at the market, but has concluded that the inefficiencies of today's aircraft models would appear to rule out their adaptability to air conditioning uses.

"Weatherbuster"

Wood Electric Co.'s new model, the "Weatherbuster," is powered by an internal combustion engine that drives a reciprocating compressor and a condenser fan. Nominal capacities range from 3 to 7.5 tons. The engine, a standard water-cooled internal combustion type, operates at a nominal speed of

1400 rpm on all models. The compressor is an open-type, slow speed (700 rpm on all models) reciprocating refrigeration compressor. Fan speed is 500 rpm. An advantage claimed for the slow operating speeds is the low sound level obtained. Further reduction of sound is obtained by burying the exhaust barrel in the ground and using the ground as a muffler, and by insulating the cabinet and louver.

Fuel consumption ranges from 90 cu ft per hour for the 3-ton unit to 100 and 110 for the 5- and 7.5-ton models respectively.

The control system is energized from either a 115- or a 220-volt 60-cycle single-phase electric circuit and consists of a refrigerant low-pressure switch, an engine vacuum switch, and an engine water temperature and oil safety switch.

The Weatherbuster is described as a refrigerant reclaiming unit. It is installed in the open on a 12-in. concrete slab at a maximum distance of 60 ft from the air conditioner. The exhaust muffler is buried 24 in. below grade.

Application

Either a chilled-water or direct-expansion type of air conditioning system can be used. It is claimed to be suitable for application with "any well-designed new or existing air conditioning system."

Cobell Industries Inc. claims the Carraway device will produce a ton of refrigerant per horsepower, which is said to be considerably better than for other gas-fuel types, which Cobell states require about 3 hp for every ton of air conditioning capacity. Initial price will run about $1500 for a unit sized to condition a three-bedroom home, the company has announced.

The unit works "in connection with any standard compressor." The 1-to-1 ratio will operate at full rated capacity under "typical" summer conditions of 95° dry bulb temperature and 75° wet bulb.

Cobell will use the device in connection with its Aqua-Fog evaporative condenser, which combines fine water spray and mist with forced air for rapid heat transfer.

Operation

It is reported that the high refrigeration-to-horsepower ratio is obtained by the manner of operation. The driveshaft from the gas engine turns a drum, which starts a similar drum on the compressor at a pre-set speed. The entire drum runs the compressor by friction, eliminating needs for belts and pulleys. Mr. Carraway points out that since the motor has no starting inertia to overcome, with the starting and running loads all being in one engine, an engine one-third the size of a conventional engine is used.

The present stage of development of the aircraft-type gas turbine-driven compressors is not such as will give a very good indication of their practicability in domestic air conditioning use. AiResearch builds a model designated as the GTC85, which is basically a two-stage centrifugal compressor assembly direct-coupled to a radial inward-flow power turbine. The unit is rated at 150 air hp "on a NACA standard sea level day." Obviously a model adaptable to domestic air conditioning uses would have to be in the range of 1 to 10 hp. Furthermore, the emphasis in design has been placed upon extremes of dependability and compactness, with the result that the aircraft unit is overengineered for domestic use. The gas turbine compressor impellers weigh less than 6 lb and are small enough to be held in a man's hand. Efficiency has been of secondary importance.

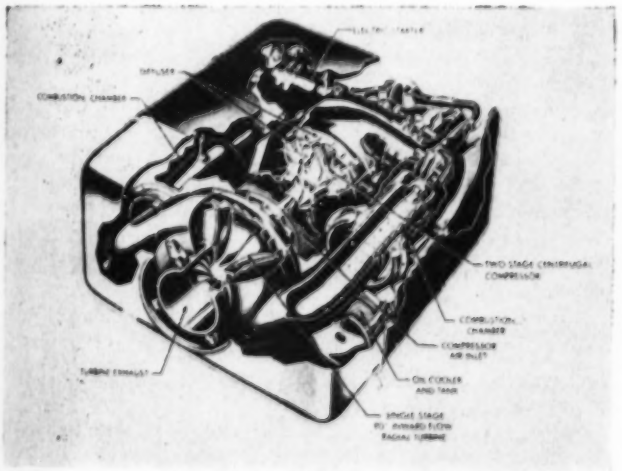
AiResearch also has a number of other models, but all are similar in these basic characteristics.

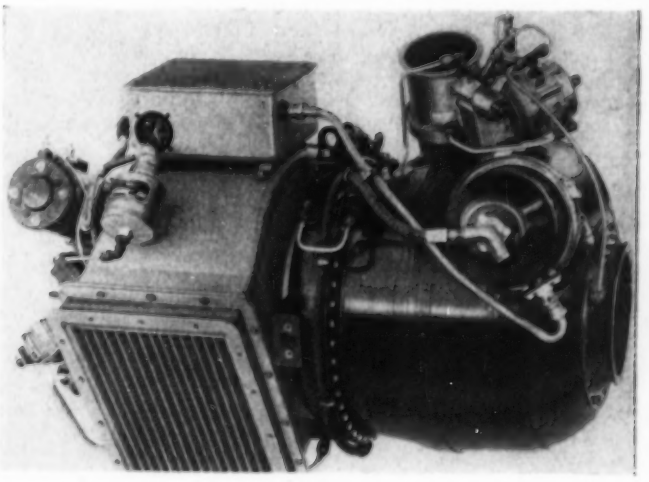
Capable gas engineers believe that the gas turbine should be cheaper to operate than any electric-driven prime mover. Operating as a heat pump to provide heat for the winter cycle, the turbine would cost less than the new electrically operated heat pumps because of both the lower energy cost and the fact that waste heat from the turbine could provide a good share of the load.

Simplicity

Also, because of its relative simplicity, the turbine should eventually be cheaper to build, they predict.

No doubt there are other companies besides Solar and AiResearch that are working on turbine-driven compressors for aircraft applications. Always bearing in mind the precariousness of having to be dependent primarily upon the government for the bulk of their contracts, they should be receptive to the idea of producing gas-fired all-year air conditioners. But it will take a concerted effort of gas industry men to persuade them that here is a real mass market. A half-million air conditioners per year—at the right price both as to investment and operation—is not an impossible goal.





Cutaway view of AiResearch's Model GTC43/44-5 (left). At right is AiResearch Model GTC85, one of a number of gas turbine compressors that the company has in production. This compact unit is rated at 150 hp.

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Automatic Overloading of District Regulator Stations, Charles C. Jones, *Aug., p. 35.*

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The Capacity of Balanced Valve Regulators, Allen D. MacLean, *Oct., p. 34.*
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How Detroit Increased Space-Heating Capacity to Supply 100,000 New Customers, Charles L. Ruff, *Sept., p. 28.*

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Maintaining Constant Gas Pressures, R. B. Fleske, *Sept., p. 38.*
Selecting a Regulator, Allen D. MacLean, *Nov., p. 45.*
Reducing Noise at Regulator Stations, F. M. Partridge, *Dec., p. 91.*

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Surveying System for Pressure Boost, Norman Burzlaff, *Feb., p. 49.*
Procedures for Installing Regulators, J. Levendusky, *Feb., p. 50.*
Safety in the Regulation of Gas Pressures, Allen D. MacLean, *April, p. 51.*
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Safety Relief and Shutoff Valves for Distribution Systems, K. R. D. Wolfe, *Oct., p. 60.*
Gas Pressure Regulation and Safety Control, Howard Evans, *Oct., p. 66.*
Preliminary Design Load Study for a Distribution System, Alden Bryant, *Dec., p. 40.*

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Should Shutoff Valves Be Put Ahead of Safety Relief Devices? K. R. D. Wolfe, *March, p. 35.*
Making High Pressure Service Installations, Kenneth W. Person, *April, p. 48.*
Designing a City Gate Station, C. S. Beard, *Oct., p. 60; Nov., p. 37.*
Complete Station Shutoff As a Means of Preventing Over-Pressure, Gordon G. Dye, *Dec., p. 55.*
Mechanical Relief Devices, Donald J. Miller, *Dec., p. 55.*
Oil Seals for Protection of Distribution Systems, *Dec., p. 53.*
Over-Pressure Protection, *Dec., p. 53.*
Push-Button Controls Denver's Gas Pressure, Everett M. Roark, *Dec., p. 33.*

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Houston's Experience With Combination Meter Regulators, H. H. Sexton, *Mar., p. 39.*
Relief Valves on Customer Meter Sets, George M. Fox, *June, p. 57.*
Over-Ride Protection of Distribution System Pressure, K. R. D. Wolfe, *June, p. 40.*
Effect of Heating Loads on the Design on a Distribution System, James F. Gary, *Aug., p. 45.*

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gas range sales

Instant full flame . . . brings foods to cooking temperature in shortest time.

"Click". . . convenient Low Frying heat . . . provides perfect widespread low heat for "most used" frying operations.

"Click". . . efficient Center Simmer maintains boiling in any covered utensil.

"Click" . . . gentle "Keep Warm" heat . . . keeps foods perfect for serving without further cooking.

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GAS new products

To secure further information on products or new literature, simply fill out the coupon and mail, indicating by number the information or literature needed.

1 Cylinder Trucks

Moellenbrock & Wilke has announced that its 1955 models of the M/W gas cylinder trucks will be furnished with toe plates made of high tensile steel.

According to the manufacturer, this feature represents a major improvement in cylinder truck construction, since it reinforces the truck at its most vulnerable point and virtually eliminates any possibility of breakage through abnormally rough handling.

Moellenbrock & Wilke

■

2 Thermometer Systems

Vapor-pressure actuated thermometer systems that record on uniform charts are now available from Bristol.

The new thermometers combine the advantages of freedom from ambient temperature effects, fast response, high torque, small bulb size, and extra sensitivity of the vapor-pressure systems with the linear scale, uniform graduations, and simple control attachments used with gas or liquid filled systems.

The linear Class 2 thermometers are ideal for partial-range and short-span automatic controllers because of their large torque and high-speed response.

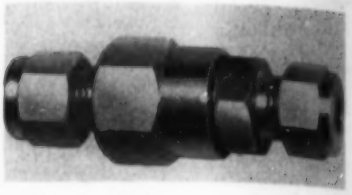
The Bristol Co.

■

3 Leak-Repair Plugs

New leak repair plugs for making permanent or emergency repairs in gas lines, tanks and boilers are being marketed by R. H. Baker & Co. Inc. Made in variety of sizes of special heat treated alloy steel, these plugs will take the strain of thread cutting themselves into a hole to effectively seal the break. For permanent repair or to reinforce weak metal, weld around the plug. In an emergency these plugs can prevent explosions.

R. H. Baker & Co.



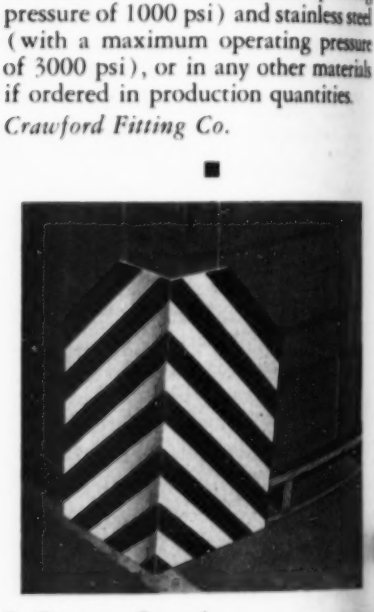
4 Check Valves

Hoke check valves with Swagelok ends are now available from Crawford Fitting Co. Hoke valves are ball-type valves designed for minimum flow resistance and to provide positive reverse flow check. Synthetic rubber forms the seat material, the spring is stainless steel, and the gasket is made of fiber.

The maximum operating temperature is 150°F. The valves are available in brass (with a maximum operating pressure of 1000 psi) and stainless steel (with a maximum operating pressure of 3000 psi), or in any other materials if ordered in production quantities.

Crawford Fitting Co.

■



5 Corner Guards

Protection of loads against traffic damage at every corner is offered with the new RAN-guard all-steel corner guard manufactured by Randolph Industrial Equipment Co.

By slipping its steel gusset under the load (either on the floor or beneath pallet), the RAN-guard helps to prevent accidents and load damage caused when lifts and trucks scrape the corner of a load. The colors of the guard are bold

Mail this Coupon for **NEW PRODUCTS INFORMATION** / **COPIES OF NEW LITERATURE**

GAS, 198 S. Alvarado St., Los Angeles 57, Calif.

4/55 Fill in numbers of items in which you are interested.

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NAME AND TITLE .....

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JOHN WOOD Automatic GAS water heaters COST LESS TO OPERATE AND YOU CAN PROVE IT!

It's SAVINGS that make sales

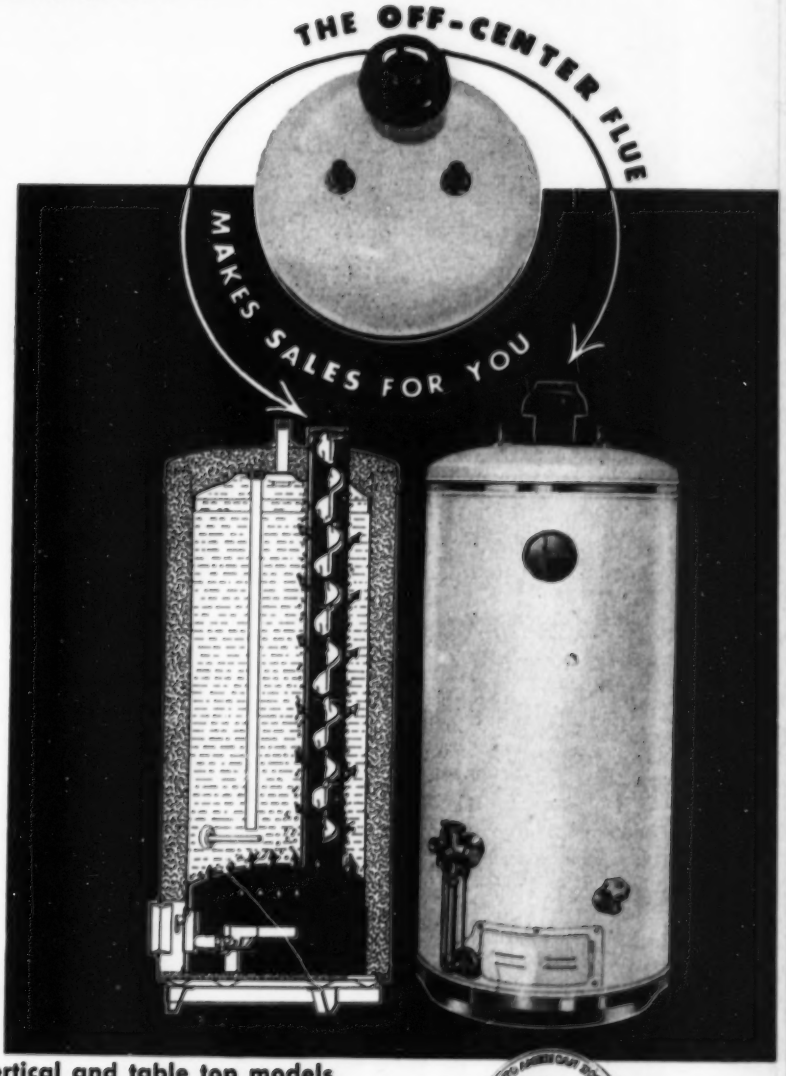
It's here—ready to work for you! JOHN WOOD has a water heater story that's a natural for sales! BY ACTUAL TEST, John Wood Water Heaters cost your customers less per gallon for hot water ...make *savings no other construction can match!* That's because the OFF-CENTER flue construction—developed and featured by JOHN WOOD—beats every known water heater construction for economy in test after test.

That one fact gives you a real edge on all your competitors. Nobody has an economy story like yours when you feature JOHN WOOD. *Nobody* has the profit chances you get with the proved JOHN WOOD economy story!

Here's potent sales material—backed up by the hardest hitting program of promotion and advertising yet—*all working for you and your bigger profits.*

Ask your JOHN WOOD representative for the full story.

Write for FREE Book "How Do You Judge a Water Heater"—Today!



BEATS the rest by EVERY test

JOHN WOOD gives you more to build sales—

- **COMPLETE LINE of sizes and styles, vertical and table top models**
- **A PRICE FOR EVERY BUDGET**
- **THE ONLY WATER HEATER OFFICIALLY SELECTED BY *Mrs. America***
- **FULL PROMOTIONAL HELPS to build your sales**

Finest glass-lined or galvanized water heater anywhere!

JOHN WOOD COMPANY

HEATER AND TANK DIVISION

Conshohocken, Pennsylvania and Chicago, Illinois

black and yellow baked enamel stripes. Available in two sizes for various sized loads, the guards can be used with all types of storage—on skids, pallets, floors, etc.

Randolph Industrial Equipment Co.

■

6 Meter Index Box

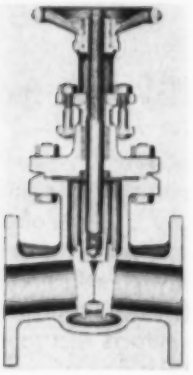
To provide a clear, unimpeded view of meter indexes on American Meter's new 5B-225 Aluminumcase meters and simplify the work of meter readers, American Meter Co. has recently announced the development of a Plexiglass index box. The new box is not affected by ordinary exposure to light or to the elements, making it equally suitable for exterior and interior setting of gas meters.

The new index box is molded in one piece of impact and shock resistant plastic. Mounting holes are integral with the box, which is readily attached to the Model 5B-225 Aluminumcase meter. The new Plexiglass index boxes are standard on 5B-225 Aluminumcase meters and are furnished when requested on American 3B, 5B, and 10B Ironcase meters.

American Meter Co.

■

7 Valve Line



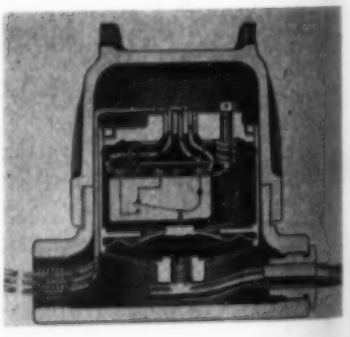
Alloy gate, globe, and angle valves are available from Crane Co. in a completely new line. Outstanding features are a split-wedge disc design in the gate valves and an improved disc-stem connection in the globe and angle valves.

The split-wedge disc is made up of two identical, circular discs placed back to back in a carrier. They have a convex trunnion on the back and an integral circumferential flange, which bears on guide slots in the valve body. Excessive force is not required for tight seating.

In the new globe and angle valve disc-stem construction, the stem extends much farther into the disc, with a minimum amount of radial clearance. Chattering of the disc is eliminated and seat wear is greatly reduced.

Crane Co.

■



8 Pressure Switch

Explosion-proof pressure and vacuum switches of unusually compact design have been announced by Barksdale Valves.

The switches, enclosed in an explosion-proof housing, cover the range from 30 in. of mercury proof vacuum

ARCCO
BETA CHART PENS
...HOLD 2 to 4 TIMES MORE INK
Beta Fountain Pens hold two to four times the ink of ordinary chart inking pens. Regardless of the line thickness Beta Pens produce a smooth unbroken and uniform line. Pens shown are approximately actual size and can be arranged to reduce time interval between static and differential lines to only a few minutes. Beta Pens are especially suitable for seven day records. Price $1.10 (lower prices in quantities).
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Available for Early Delivery
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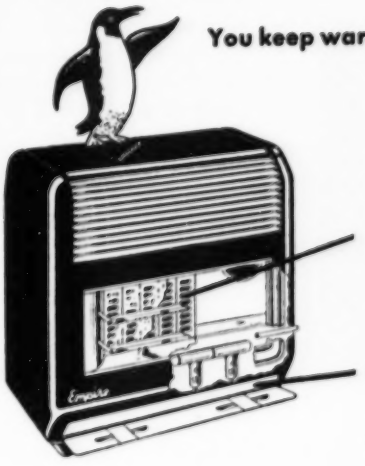
MAKES THE BEST *Gas* HEATING APPLIANCES IN THE WORLD

There's NO DOUBT *about it!*

You keep warm... your cabinet keeps cool!



FULL VIEW OF FIRE

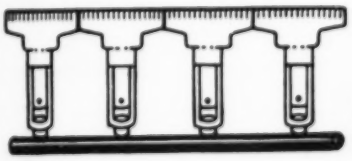
An abundance of warm, cheerful radiant heat is produced by the unusually large radiant area.

SERVICE FROM FRONT

Complete burner assembly accessible for servicing from this handy service door. Burners always in full view of serviceman. Not necessary to remove glass and radiants to service burner.

Gas CIRCULATOR HEATER

WITH THE FAMOUS *Thriftmatic* GAS BURNER



MOST EFFICIENT *Gas* BURNER

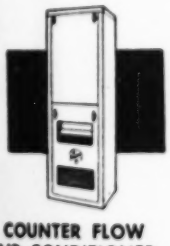
SILENT IN OPERATION

MINIMUM FIELD SERVICE

DEALERS ACCEPTANCE

USER SATISFACTION

EMPIRE MAKES YOUR JOB EASIER



COUNTER FLOW AIR CONDITIONER

Gas FLOOR FURNACE

WINTER AIR CONDITIONER

ZONE CONTROL RECESSED HEATER

EASIER SALES . . . EASIER INSTALLATION . . . EASIER SERVICE

EMPIRE STOVE COMPANY

BELLEVILLE, ILLINOIS

to 150 psi pressure, sensing increasing or decreasing vacuum or pressure. Standard models are available for single or dual settings. The latter will secure two different pressure (vacuum limits) and actuate two electrically independent circuits, one ac and the other dc, if desired. The units are automatically reset by the snap-action characteristic of the switches.

Barksdale Valves

■

9 Steel Vault

E. H. Wachs Co.'s new prefabricated steel vault has been developed to give the gas industry a standardized, ready-made vault for underground distribution work. Designed for residential areas and open country where a small, shallow vault is adequate for high pressure gas lines, the vault is heavily constructed and designed to withstand any frost action or ground water pressure that would be encountered. It is completely waterproof.

With the Wachs vault, it is only necessary to dig the required hole, drop the vault in, make the piping connections, and backfill. The covers are made of heat-treated aluminum floor plate, supported in the center by a removable aluminum H beam. A full 5-ft square opening is available for installation and service work. The vault is supplied with suitable neoprene gaskets for a water tight closing of the cover.

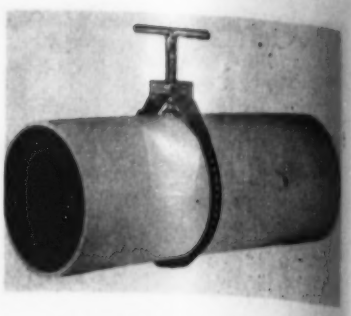
E. H. Wachs Co.

■

10 Plug and Clamp

A neoprene rubber strap-on plug and clamp assembly especially designed to stop leaks before affixing and welding the shoe to damaged pipelines has been developed by the D. W. Moor Rubber Corp.

The neoprene rubber plug is laminated to a perforated steel strap with a steel disc supporting the back of the plug. The pliable softness of the plug



allows it to flow readily into all cavities, pits and cracks for a tight seal.

The clamp applies the plug to the leak in seconds. The holes in the strap fit over pins on the clamp; the clamp is tightened, and the plug seals the leak.

D. W. Moor Rubber Corp.

■

11 Controller

In conjunction with suitable control valves, Foxboro's new Model 41A controller can be used in gas production, transmission and distribution systems for pressure reduction and back-pressure regulation.

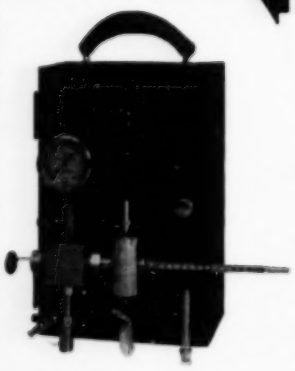
Replacing the earlier Model 41, the new controller provides sharp on-off or narrow band proportional control of such variables as temperature, pressure, liquid level, and humidity.

DEW POINT TESTER AND RECORDER

BUREAU OF MINES TYPE

for testing gases under pressure.

Records dew point of gases under pressure.



- **PRECISION DETERMINATIONS:** Bureau of mines tests show that with manipulation dew points can be duplicated to within 0.2°F.
- **ACCURACY:** Averaging test measurements, the Bureau of Mines reported less than 0.2°F. Dew point temperature difference compared to known standards.
- **SAFETY:** Hydrostatic tests show a maximum working pressure of 3,000 psi. Adjustable mirror allows for safe visual observation into the pressure body.
- **SUITABILITY:** For use with gases under pressure; at pressures from atmospheric to 3,000 psi.
- **CONTINUOUS RECORD:** of dew point gas
- **RAPID RESPONSE:** To changing dew point of gas
- **RELIABLE RESULTS:** Obtained to allow for the control of dew point of natural gas in long distance high-pressure transmission lines.

This instrument records dew point of a continuous sample of natural gas at line pressure up to 1,500 psi.

cenco

Cenco . . . one dependable source of supply for everything you need in scientific instruments and laboratory supplies. Over 15,000 items . . . 14 branch offices and warehouses.

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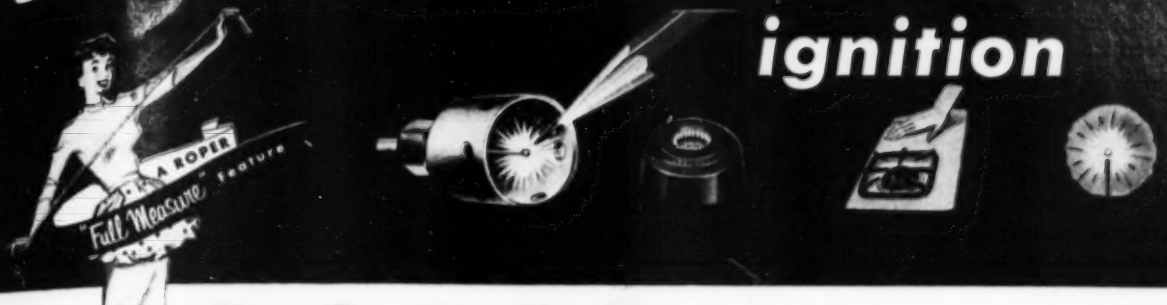
SANTA CLARA LOS ANGELES TORONTO MONTREAL VANCOUVER OTTAWA

Sensational New "INSTA-LITE" ignition



ROPER

"AMERICA'S FINEST GAS RANGE"

This remarkable new ignition system, developed by ROPER in co-operation with A. G. A., provides a far superior type of automatic lighting for top burners, oven and broiler. Just a tiny bead of gas flame does the job . . . instantly and effectively. Fuel consumption is appreciably lowered. Range cooking top stays absolutely cool.

Here is an important new feature to present to your prospects. It will clinch many a sale for YOU.

Geo. D. Roper Corporation, Rockford, Illinois

Qualified retailers are invited to write for full information on exclusive ROPER franchise.

Company Name _____

Individual's Name _____

Street Address _____

City _____ **State** _____

G455

new products • *Cont'd.*

Left-to-right indicating scale with white-on-black numerals and graduations has been lengthened to 5 in., improving readability and accuracy.
Foxboro Co.

■

12 Valve

The new Luncor valve, which, according to the Lunkenheimer Co., is the first all molded PVC valve and fitting, is made through an exclusive molding process that gives the PVC material exceptional strength, protects its natural corrosion resistance, and reduces manufacturing costs.

Basic material used for the new valve, which is resistant to most chemicals used in industry, is polyvinyl chloride. The valve is presently available in a Y-type globe design.

A complete line of plastic fittings made of the same material is also available from Lunkenheimer.
Lunkenheimer Co.

■

13 Aluminum Metal

A new aluminum die-cast gas meter, has been introduced by Rockwell Manufacturing Co. Intended for commercial and industrial services, the new large capacity Rockwell "No. 4" weighs only 176 lb as compared with 600 lb for Rockwell's cast iron meter of the same capacity and working pressure. Designed for working pressures up to 100 psi, it can accommodate flows up to 2250 cfh at ½-in. wc pressure loss and 5000 cfh at 2-in. wc pressure loss when handling 0.60 s.g. gas.

Stainless steel inserts provide corrosion-resistant wearable threads in the index plate holes on the cover, the four cap-screw holes at the ends of the body and in both the inlet and outlet.

The meter is also equipped with steel feet, ½ in. high, for insulation. All internal parts of the new aluminum meter are interchangeable with those of the cast iron counterpart.
Rockwell Manufacturing Co.

■

14 Solenoid Valve

A new solenoid valve that uses a spring-loaded synthetic valve has been introduced by Minneapolis-Honeywell.

The soft-seat valve is made of Buna N rubber and features increased capacities, replaceable coils, and

BAKER CIRCLSEAL CLAMPS

REPAIR FULL BREAKS QUICKLY in steel, cast iron and asbestos-cement pipelines with Baker CirclSeal Clamps*. They provide a fully cushioned wrap-around for the pipe — are light in weight, easy to handle. A compounded rubber gasket with intermeshed teeth supplies a complete seal even on out-of-round and damaged pipe.

No shut down for repairs is needed when you use Baker CirclSeal Clamps. They can be installed in wet ditches without draining and filling of the line during repair work. Just wrap the CirclSeal Clamp around the line and draw up the bolts. *HiPressure Bolts never bend!* Due to the flexibility of the CirclSeal Clamp, your pipeline is repaired and *insured* against recurrence of breakage due to line strains.

R. H. BAKER & CO., INC. • 2070 E. Slauson Ave., Huntington Park, Calif. • Kimball 9241

HI PRESSURE LUG compounds full pressure of bolt to compress the gasket around the pipe. This prevents bending, assures "first try" success!

RUBBER SEAL has large matched teeth that intermesh easily, provide perfect seal against leakage.

WRITE TODAY *for fully illustrated catalog in color which gives specifications, prices and complete information about CirclSeal Clamps and HiPressure Leak Repair Clamps!*

Construction: 36 ounce heavy Copper or 20 gauge Stainless Steel sleeves; ½" CadPlated or Silicon-Bronze bolts; the new HiPressure Lug which eliminates bolt bending and holds higher line pressures; special intertoothed Lastite rubber gasket to insure constant gasket thickness on uneven pipe.

*Pat. Pending

BAKER CIRCLSEAL PIPE CLAMPS

the use of a conical spring-loaded plunger, which presses the valve disc snugly against the seat. Use of a "rotatable" head makes installation easy and makes it unnecessary to loosen the body union nut to reposition the conduit spud. A separate doughnut-type coil is provided.

The valve is available in ¾-in., ½-in. (standard and large), and ⅜-in. sizes.

Minneapolis-Honeywell Regulator Co.

■

15 Tractor-Backhoe

A new crawler tractor-backhoe combination said to offer greater traction and flotation, greater stability, and more power for operating the hydraulic digger has been announced by the American Tractor Co.

The Terra-Trac-Pippin special is claimed to have special advantages for digging drainage ditches, pipeline trenches, etc. With a Terra-Trac tilt-loading trailer, the new unit is reported to make an ideal combination for locating and repairing pipeline leaks.

American Tractor Co.

■

16 Back-Pressure Regulator

A back-pressure regulator with integral controller for services where close regulation and complete closure are required in a single instrument has been introduced by Black, Sivalls & Bryson.

Designed for optimum control on gas gathering lines and other equipment, the BS&B Type 73-22 works equally well, within its pressure limitations, in all gas or air services that require back pressure regulation.

Construction features include a high-tensile cast iron valve body, spring housing, and diaphragm casing; pressure transmission tube; pilot operating mechanism machined from stainless steel and aluminum. Available sizes: 2-in. screwed globe and 3- and 4-in. flanged globe. Control range: 5 to 125 lb. Temperature range: up to 165°F.

Black, Sivalls & Bryson Inc.

GAS trade literature

17 Honeywell Catalogs

Two catalogs are available from Minneapolis-Honeywell. (When ordering, use letter preceding description together with number of head.)

(a) A four-page bulletin describes Honeywell's new Adatrol, the new control that allows on-the-job addition of thermostatic gas valve, pilot-line filter, and "hi-lo" bypass.

(b) Honeywell's new Aqua-Maid gas water heater control is also described in a four-page bulletin. This new control features two interchangeable models, new wrap-around styling, and 20 special design features.

Minneapolis-Honeywell Regulator Co.

■

18 Specification Booklet

Delco-Remy's 1955 edition of the DR-324S Test Specification booklet has been revised to include the most recent specifications for all active models of Delco-Remy batteries, coils, distribu-

"This Quality Control Number Is Your Proof that M·S·A FIRST AID KIT Items are Fresh, Pure, Sterile"

Every step in manufacture, all supplies that go into the new M.S.A. First Aid Kits are keyed to the number stamped on each Unit "D" package. This identity is your assurance of *individual responsibility* on our part . . . the best possible guarantee of product protection to you.

MORE THAN 60 ITEMS GIVE YOU COMPLETE SELECTION

You name it, we have it! 12 different packages of antiseptics; 15 various kinds and sizes of bandages and dressings; over 21 burn treatments; and more than 15 miscellaneous items, including eye treatment, snake bite kits, poison ivy ointments, and many others. Write for details.

MSA SAFETY EQUIPMENT HEADQUARTERS

MINE SAFETY APPLIANCES CO.
201 North Braddock Avenue, Pittsburgh 8, Pa.
At Your Service: 82 Branch Offices in the United States and Canada

tors, generators, cranking motors, regulators and magnetic or solenoid switches. The list price of the DR-324S is 25 cents each, with a special price for quantities of 10 or more.
Delco-Remy Div.

■

19 Boiler Bulletin

Worthington Corp. has issued a new bulletin on types AO and BA cast iron gas-fired boilers for hot water, steam heating and hot water supply. The new bulletin consists of a three-page fold-out, which illustrates in color the AO and BA units. A cutaway of each unit shows various working parts. Specifications tables are included for each type boiler.
Worthington Corp.

■

20 Combustion Bulletin

A factual and photographic roundup of how Hagan automatic combustion control systems are being used with various types of gas-fired boilers is presented by Bulletin MSA-116. The 14-page bulletin shows by a series of pictorial diagrams the application of control equipment as the boilers increase in size.
Hagan Corp.

■

21 Control Catalog

A new 32-page catalog describing the complete line of White-Rodgers automatic controls for heating, refrigeration, and air conditioning has just been released. Featured are the new Cushioned Power Solenoid gas valves and improved automatic pilots. Controls for special applications are also shown.
White-Rodgers Electric Co.

■

22 Valve Bulletin

Ohio Injector Co. has issued a four-page bulletin describing its 500 line of 200-lb bronze valves. The bulletin presents cut-away drawings of the valves, together with specifications.
Ohio Injector Co.

■

23 Punch-Card Folder

How to get more from punched-card methods with modern Remington Rand machines is described in a new six-page illustrated folder. In easy-reference chart form, the complete line of Remington Rand punched card machines is listed, showing their use in applications common to both large and small businesses. An illustration and a short factual description is given for each of the Remington Rand punched-card machines.
Remington Rand Inc.

■

24 Relay Booklet

How to select a magnetically or mechanically held relay is shown in a new publication, "Relay Selection Tabulations" (No. 553), issued by Automatic Switch Co. Circuit diagrams are supplied.
Automatic Switch Co.

■

25 Mixer Bulletin

Eclipse Fuel Engineering presents details and specifications of its Vari-Set proportional mixer with adjustable jet in a new bulletin. The bulletin features a selection chart and a series of capacity tables.
Eclipse Engineering Co.

BETTER
BEST
When it comes to the diaphragm data in your meter service records, you'll see better over-all accuracy and longer service life with Lancaster Groove Type Metal Rim Diaphragms in your meters.
From the groove type design which assures equal leather at both "in" and "out" stroke extremes . . . to the fine specially processed leather itself, Lancaster has the edge in practical engineering, quality materials and precision workmanship.
Send for a sample and see for yourself
METER PARTS CO.

No woman ever cooked like this before!

NEW FLORENCE "GOVERNESS" BRINGS AUTOMATIC HEAT CONTROL TO TOP-OF-STOVE COOKING!

Now enjoy *automatic heat control* in the "neglected 80%" of all cooking . . . *the kind you do on top of your stove!* The new Florence Range "Governess" automatically holds food exactly at any pre-selected temperature, as it cooks, with no help from you! You can now do surface-burner cooking with the same sureness and convenience you enjoy in your automatic oven. You can do perfect deep-fat frying, sauteeing, griddle and pan frying . . . without scorching, sticking, or boil-overs . . . and without any extra gadgets or appliances! It's cooking luxury you've never dreamed of . . . with the exciting new Florence Gas Range "Governess."

No Scorching! No Sticking! No Boil-over!

JUST SET DIAL FOR PROPER TEMPERATURE AND THE "GOVERNESS" DOES THE REST!

It's so simple and easy! Just set the thermostat dial. Then the Florence "Governess" controls the flame, up or down, to maintain the food itself at the exact temperature you select, *automatically!* It ends pot-watching. It gives you *consistently* good french fried potatoes, shrimp or chicken, griddle cakes, bacon and eggs . . . dozens of other dishes . . . each done to unbelievable perfection every time! Ask to see a demonstration today.

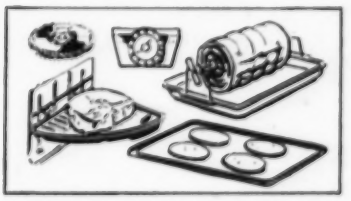
The "Governess" on your new Florence Gas Range makes your cooking obey, when you're away!

Guaranteed by Good Housekeeping

Let Florence do your cooking

NO EXTRA GADGETS NEEDED WITH THE FLORENCE "GOVERNESS"

Extra gadgets and appliances become unnecessary when you have a new Florence "Governess" Range. Any pot is a deep-fat fryer, any pan is a controlled-heat skillet!



FLORENCE IS FAMOUS FOR MANY QUALITY FEATURES

The "Governess" is the latest in a long list of Florence quality features. Ask to see the exclusive new 3-way Range Top, the new Harper-Wyman Alltrol Burners, the convenient Hi-Swing-Out Broiler and the famous Florence Roto-Broilercue!

NOW YOU CAN AFFORD A "GOVERNESS"

You'll be amazed at the low prices of the many handsome models shown at your Florence dealer. See them!

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GAS RANGES
SINCE 1874

Write for free folder on the new Florence "Governess" Gas Ranges
Florence Stove Company
Merchandise Mart • Chicago 54

GAS news

Idaho PUC will rehear case of who will serve state

A rehearing by the Idaho PUC on the matter of which company will distribute natural gas in southern Idaho has been asked by the Intermountain Gas Co., which threatened to take the issue to the state supreme court if necessary.

Idaho Natural Gas Co. was granted exclusive rights to the territory by the commission because the company promised to serve more customers at lower rates than two other applicants (Intermountain and Pocatello Gas Co.).

The commission's order climaxed a three-cornered battle among the companies for permission to distribute gas, which Pacific Northwest Pipeline Co. is scheduled to bring to the state by this fall or the spring of 1956.

"The Idaho complany plan . . . reflects a more realistic approach to the Idaho situation," the commission said.

The commission's order gave Idaho a certificate of convenience and necessity to serve 30 counties in southern Idaho.

General Controls to buy control division of Perfex

An offer by General Controls Co., Glendale, Calif., to purchase the assets of the Controls and Instrument Division of the Perfex Corp., Milwaukee, has been accepted, according to W. A. Ray, president of General Controls.

The transaction involves the purchase of the assets of this division of Perfex in return for an undisclosed amount of General Controls preferred and common stock.

At the present time, General Controls will operate the newly acquired facility as the Perfex Division. The present management will be retained for the time being. In addition to a U. S. plant located in Iron Mountain, Mich., General Controls Co. has also obtained, through this purchase, the manufacturing facilities of Perfex Controls Ltd., wholly owned Canadian subsidiary of the Perfex Corp., with a plant located in Guelph, Ontario, Canada, near Toronto.

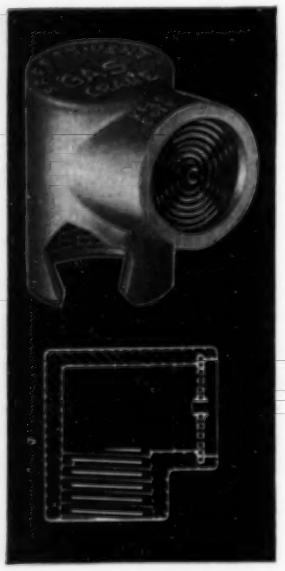
Petroleum Engineer buys American Gas Journal

The 96-year-old *American Gas Journal*, monthly publication of the gas utility industry, has been purchased by the Petroleum Engineer Publishing Co., Dallas.

Hilding H. Carlson, who has been editor, was appointed editorial director by the new management.

Two and one-half million heating customers predicted

During each of the next two forthcoming summers an additional one and one-quarter million homes throughout the nation will install equipment to permit them to heat with gas bringing the total number of gas-heated homes to 16.5 million by the beginning of the 1956-57 winter season. These totals are indicated in the most recent *AGA Gas Househeating Survey*, the results of which have just been released by the Bureau of Statistics. The number of ex-



New CRANE ¾-inch Safety Vent Elbow with non-clogging screen

Here's a basic improvement in gas vent elbows. A flexible stainless steel coil spring takes the place of the old bar grate or rigid screen that clogged so easily. In normal, or closed position, the space between the windings of the coil spring is small enough to keep out insects, dirt, etc. But gas pressure from behind easily flexes the spring outward, enlarging the space between coils for full-open venting of gas and the expulsion of foreign matter.

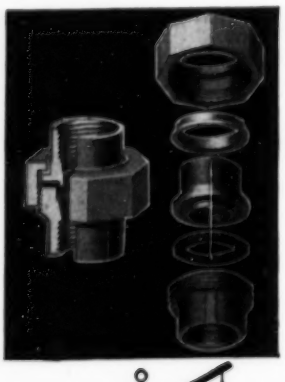
Durable, dependable—die cast of zinc alloy with integrally cast cross bar to prevent the coil spring from being jammed back into the fitting. *Thousands already in service.*

Check your Crane Representative on both these new items!

New CRANE Insulated Union

Gives Cathodic protection at meters

Install this new insulated union at the gas meter for cathodic protection against galvanic corrosion. Special gasket and washer with high dielectric strength effectively break the electric path. Regular ¼-inch size in Crane malleable iron.



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Branches and Wholesalers Serving All Industrial Areas

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sell quality for every market

De luxe units for the discriminating homeowner . . . standard units for the mass "new home" market. "Mr. B" sells 'em all—BRYANT, of course!

be "Mr. B"

(AUTHORIZED BRYANT HOME COMFORT DEALER)

Only "Mr. B"—the Bryant Home Comfort Dealer—has *all 8* of these selling assets to build his business BIG:

1. A name customers know and want
2. The most complete line of automatic heating, air conditioning, water heating
3. Quality equipment for every market
4. Exceptional distributor service
5. Professional sales training
6. Personalized selling tools for you
7. National advertising featuring you
8. Co-op "Mr. B" ads for local papers

For bigger profits now, for a secure and prosperous future—see your Bryant Distributor. Ask him about Bryant's big "Mr. B" action program, and how it can make sales and money for you!

bryant®

AUTOMATIC HEATING
AIR CONDITIONING
WATER HEATING

pected incremental gas heating customers is quite similar to the totals indicated in similar previous studies and represents a continuation of the postwar trend in the preference of the American public for gas heat.

The most significant gains during the next two heating seasons will occur in the east north central states where approximately 350,000 new heating customers will be added each year, thus increasing the number of heating customers in this area by 27%. The addition of 342,000 gas-heated homes in two years will increase heating customers 22% in the middle Atlantic Area; New England, starting from a relatively low level of gas heating, will add 113,000 users, equivalent to an 89% advance.

EXPECTED NEW GAS HEATING INSTALLATIONS (Thousands of Customers)

Region	For 1955-56 Heating Season			For 1956-57 Heating Season		
	Total	New Dwelling Units	Existing Dwelling Units	Total	New Dwelling Units	Existing Dwelling Units
United States	1,243	701	542	1,258	690	568
New England	54	12	42	59	12	47
Middle Atlantic	173	78	95	169	77	92
East North Central	343	108	235	352	111	241
West North Central	115	61	54	124	51	73
South Atlantic	87	63	24	85	63	22
East South Central	51	34	17	48	34	14
West South Central	166	117	49	162	115	47
Mountain	66	49	17	71	56	15
Pacific	188	179	9	188	171	17

It is expected that 56% of the new installations during the next two summers will be attributable to the construction of new dwelling units, with the remainder representing conversions of existing homes. One year ago, the industry expected only 52% of new heating installations for the same summers to occur in new dwelling units; the change reflects the unexpectedly high rate of new housing activity evident during 1954 and which promises to continue at least during the major portion of 1955.

The only regions where conversions of existing units continue substantially to exceed new homes as a source of additional heating customers are New England and the East North Central areas. The recency of natural gas introduction in the former area, together with the relatively unfavorable price of gas compared to competitive fuels, has not yet permitted the development of any substantial amount of gas heating business; this fact, combined with the low rate of population growth and new housing, causes the existing home market to be the more important one. The need for restrictions on heating installations because of temporarily inadequate gas supplies has resulted in significant backlogs of heating applications among exisiting dwellings in the East Central states, thus accounting for the predominance of this category. In the entire western part of the country and particularly in the Pacific states, the predominance of new housing in the heating market is most evident. In these areas saturations are already so high that relatively few exist-

beat today's high costs

with THERMAC nbination

Install this assembly and forget it — the most economical combination of Regulator and Valve on the market today. By combining these two universally accepted products, the Thermac Appliance Regulator with Thermac's specially heat-treated aluminum alloy gas shut-off valve, an unusually low cost assembly is assured.

The Regulator itself — the Thermac "T" Series, is very simply and ruggedly designed with so few parts it is practically fool-proof. High in capacity — easy to install in cramped and crowded quarters. Easy to service without removal from line. All these features plus universal acceptance by *leading* appliance builders means that your selection of Thermac will be highly regarded wherever your appliances are sold.

Compare these fine products in any way you choose — performance, quality and price — and you will choose Thermac. Get full information on the above assembly today.

THERMAC COMPANY

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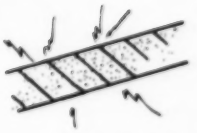
"Over 23 years' experience building gas controls"

Add Years to the Life of Any Pipe

★ Bottom of the ditch repairs



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★ Field welded joints of pre-wrapped pipe

with DURA-TAPE, the wrapper with the built-in primer!

This amazing cold application tape greatly increases the life expectancy of your pipe by providing an electric insulator, mechanical shield and a chemical inhibitor. DURA-TAPE is economical, eliminates risk to personnel and can be applied in any weather condition by hand or machine. Its built-in primer is non-drying. Write for full information.

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Sinclair's vast production facilities, including refineries, storage plants, tank cars and trucks are your assurance of a dependable supply of Sinclair LP Gas at all times . . . even in peak demand periods. Moreover, you can be sure of a trouble-free operation when you have uniform high quality and high heating value Sinclair LP Gas in your Butane and Propane installations.

Trained and experienced Sinclair engineers, men who are familiar with *your* problems, stand ready to serve you. Contact Sinclair today.

SINCLAIR
A Great Name in Oil

Sinclair Oil and Gas Company
Liquified Gas Sales Department
Sinclair Oil Building, Tulsa, Oklahoma

ing homes exist as gas conversion prospects.

Nearly 1.1 million new heating customers were added to gas utility lines for service during the 1954-55 heating season. This raises the total number of heating customers currently being served by the industry to 14.0 million. More than 3 million of these are located in the Pacific states with more than an additional 2.5 million being located in each of the East North Central and West South Central regions. Saturations of heating customers, as a percentage of total residential customers served, exceed 90% in the West South Central, Mountain, and Pacific areas but are still less than 10% in the New England states. For the entire country, the heating saturation has now reached 50.6% and is expected to approximate 60% within another two years.

EXISTING AND POTENTIAL GAS HEATING CUSTOMERS SERVED ON DEC. 31, 1954
(Thousands of Customers)

Region	Total Residential Customers	Householding Customers	Potential Householding Customers
United States	26,105	13,991	21,792
New England	1,535	127	313
Middle Atlantic	6,774	1,549	5,568
East North Central	5,946	2,537	4,614
West North Central	2,029	1,391	1,747
South Atlantic	1,851	952	1,646
East South Central	978	736	952
West South Central	2,776	2,761	2,776
Mountain	784	734	751
Pacific	3,432	3,204	3,425

still selling LARGE sizes

If it's a big size, and you quickly surmise
regulation is in the plans.
Just call on Maxine, for she has a routine
that can usually meet your demands.

With the help of an elf, she takes from the shelf
just the right size for your job.
In case that still pinches and you need more
inches,
she stretches it out on a hob.

Maxitrol stocks, without fancy locks,
for rush shipment all over, you know,
A complete range of sizes with 3" the largest
they feature advanced
"STRAIGHT-THRU-FLOW".

Spend just 3c, so from this day hence
a catalog will be within reach.
When you need a large size, you'll soon realize
that Maxine is truly a peach.

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Originators of "STRAIGHT-THRU-FLOW"

SOLD ON THE PACIFIC COAST BY PACIFIC SCIENTIFIC CO., SAN FRANCISCO • LOS ANGELES • SEATTLE • PORTLAND

Affiliated Gas merger with Carrier approved

Stockholders have approved the merger of Affiliated Gas Equipment Inc. into Carrier Corp. Under the plan, Bryant, Day & Night, and Payne operating divisions will be continued under the direction of Lyle C. Harvey, AGE president, who will become senior vice president of Carrier with headquarters in Syracuse, N. Y.

The Bryant division will be headed by Ronald N. Campbell, vice president, and Howard L. Clary, vice president in charge of sales. William J. Bailey, vice president, will continue to manage the Day & Night and Payne divisions.

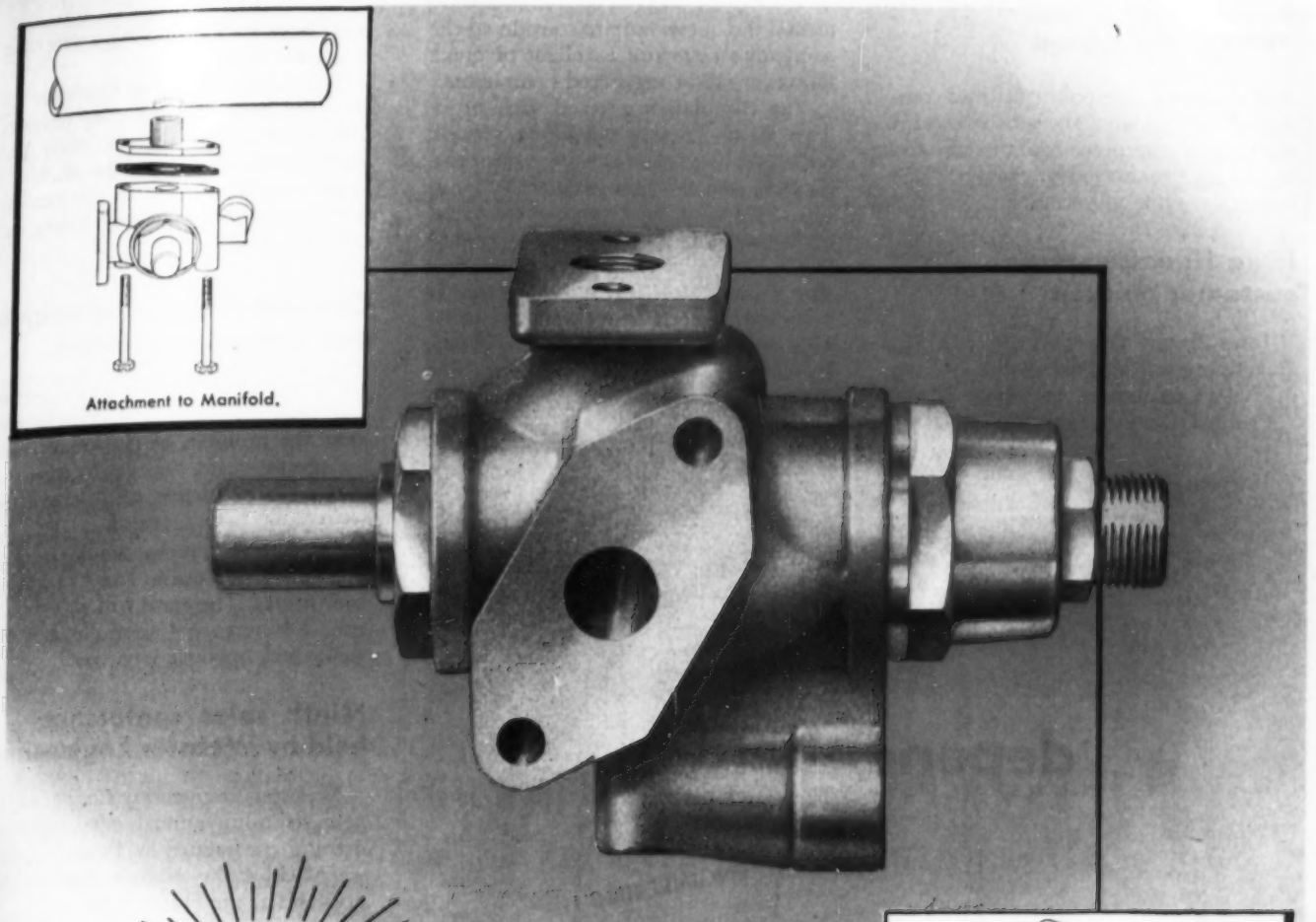
State legislature to affect public utilities

Current and prospective legislative developments affecting public utilities throughout the country include the following:

In Arkansas a bill that it is said would increase from 30 to 120 days the period utilities must wait before putting rate increases into effect under bond was enacted. Another measure, passed by the house and awaiting senate action, would eliminate the bond clause altogether and prevent utilities from increasing rates until after hearing by the state PSC. Also passed by the house and sent to the senate was a bill to prohibit the inclusion of advertising and public relations expenditures designed to promote a rate increase, in the operating costs going into utility rate bases.

An Iowa state legislative proposal

Attachment to Manifold.



THE NEW BASO® VALVE for GAS RANGES

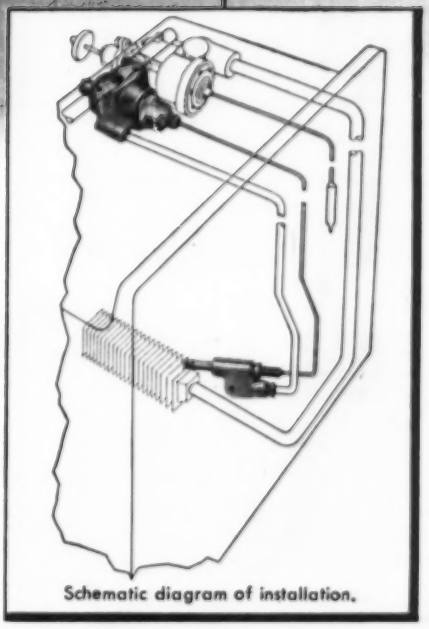
Complete gas shut-off, plus proved reliability and absolute simplicity . . . these unique benefits are *all* present in the new Baso Valve No. 812G. It's small, mounts either on top of the manifold or below it, and carries the oven thermostat on either the left or the right side.

A simple screw-in mounting flange attaches it to the manifold and most standard controls may be bolted directly to it without adapters. Reset button is conveniently located, projecting through the manifold cover beside the oven thermostat knob.

SAFE LIGHTING—Since oven pilot gas is drawn from this Baso valve, *no* gas can reach the oven burner, during the resetting or lighting cycle, until pilot burner is lighted and the Baso valve is holding open.

COMPLETE SHUT-OFF—Because the Baso valve is located between manifold and oven control, pilot flame failure and consequent closing of the Baso valve shuts off both the pilot burner and the main burner gas.

For high flame stability and low consumption—approximately 100 BTU/hr.—match the new Baso 812G with the Annular Type H non-aerated oven pilot—write



Schematic diagram of installation.

MILWAUKEE GAS SPECIALTY CO.
Dept. SC-4
MILWAUKEE 1, WISCONSIN

would create a state public utilities commission, which would be substituted for the present commerce commission, and would be empowered to regulate such matters as rates and financing.

Iowa-Illinois surveys customer opinion

Iowa-Illinois Gas & Electric Co., Davenport, reports that out of a survey of 72,931 customers, to which 12,600 responded, most of the people who returned the questionnaire considered the company's service excellent or good. However, 1064 registered complaints.

The complaints covered such problems as inadequate telephone service, unfavorable contacts with some employees, and low gas pressure or voltage. Following the receipt of each card noting a complaint, a letter was written to the customer. The company reports that these follow-ups have apparently been very successful in bringing about a better understanding and more friendly relations with those customers. In cases where low pressures were mentioned, a check was made and if such conditions were found, steps were taken to correct them.

The survey, which will continue this year, has indicated that many phases of Iowa-Illinois' efforts to maintain good public relations are paying off, with a large number of cards commending servicemen, meter readers, tellers, and other employees.

Gas and coalmen agree upon gas storage regulation

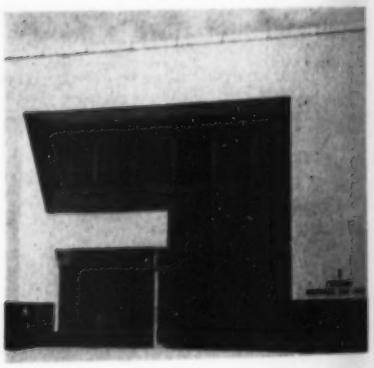
Pennsylvania natural gas operators and coalmen, who have been fighting over the problem of gas storage wells for several years, will get together and back a bill regulating gas storage in the state, it has been revealed.

The bill will make gas storage pool operators responsible for gas leaking into mines. The state will also control tests for new pool sites, plugging old wells, and opening new ones.

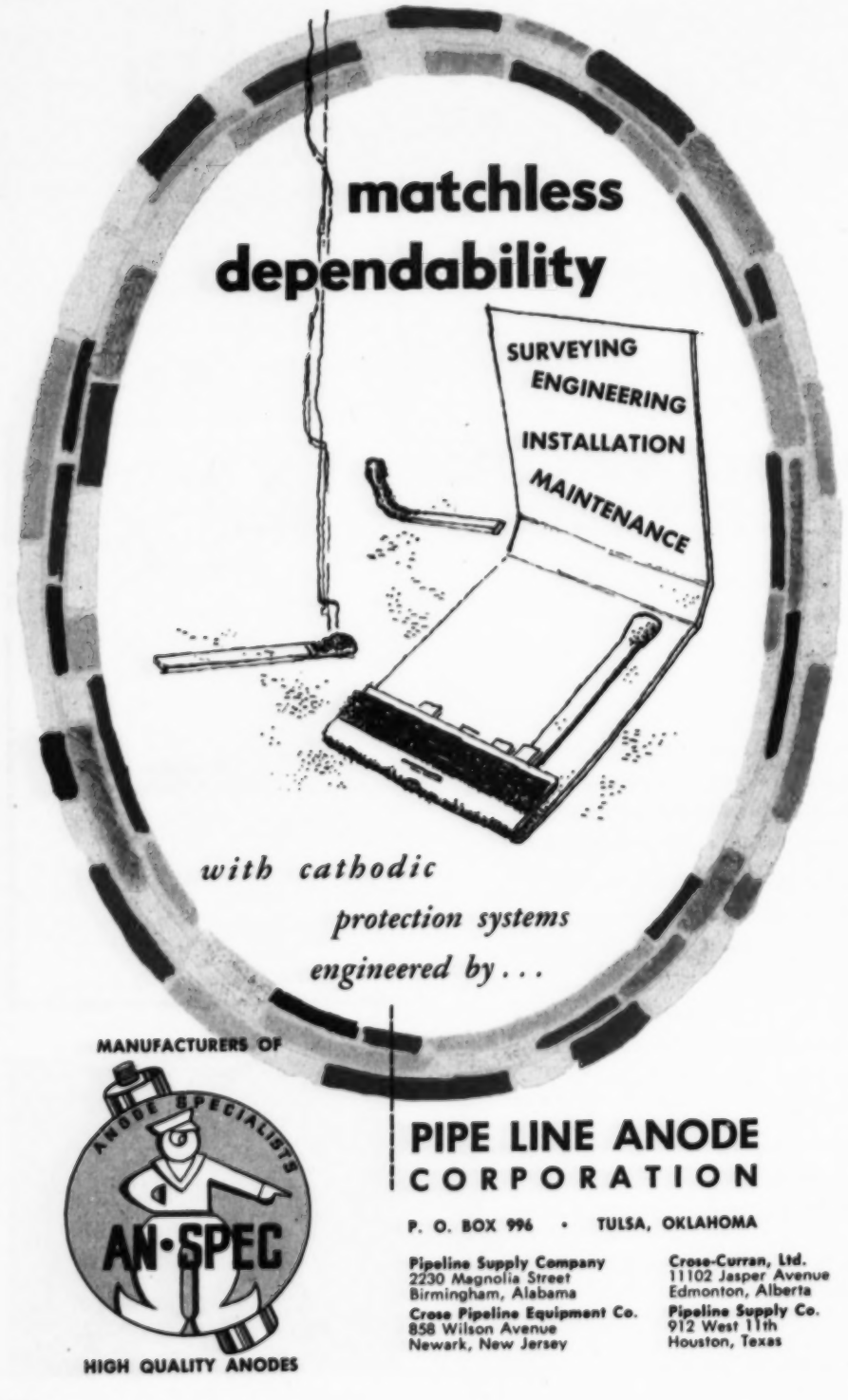
Ninth sales conference held by Webster Engineering

Webster Engineering Co. recently held its ninth annual sales and engineering conference in Tulsa. Meetings were held at the Webster plant and offices and at the Hotel Tulsa.

The program, headed by L. S. Reagan, vice president and general manager, combined discussion periods, displays and demonstrations of new combustion equipment. The general theme of the program was "Basic Combustion Engineering." The sessions were attended by more than 100 engineers, sales repre-



Corning (N. Y.) Gas Co. conducted a plant expansion program in 1954 involving expenditures in excess of $1 million. Among the projects was this new general office building. The company, which distributes gas in Corning and its suburbs, is headed by W. P. Patnode, president, and J. E. Barry, executive vice president. Among its industrial customers are Ingersoll Rand at Painted Post, N. Y., and the Corning plants of the well known Corning Glass Works. The company has allotted $350,000 for new facilities in 1955.



sentatives, manufacturers and company officials.

Featured speaker on the program was Frank H. Adams, president of Surface Combustion Corp., Toledo, who is also president of The Webster Engineering Co.

Special engineering meetings were conducted by George C. Bergtholdt, chief engineer of Webster; K. Scotty Jaeger, assistant chief engineer, and L. S. Reagan.

Indiana utilities show record-breaking expansion

Record-breaking expansion of public utilities in Indiana, especially in the fields of power and light, fuel and communication, is noted in a report released by the state public service commission.

A commission spokesman said this expansion was shown by a 57.4% increase in fees received by the PSC for 1954 over those for 1953.

The largest amount of the fee income represents a payment of 25 cents on each $100 of financing by public utilities through stock sales or bond issues. During 1954 seven of the state's largest utilities financed nearly $250 million for expansion projects, the report said.

Several of the large utility companies and the amounts financed for expansion in 1954 were: Indiana-Kentucky Corp., $65,428,880; Public Service Co. of Indiana, $51 million; Indiana-Michigan Electric Co., $24,101,600; Northern Indiana Public Service Co., $13,079,600, and Southern Indiana Gas & Electric, $9,141,600.

By way of clarification

A caption appearing in the article, "Columbia gas solves a distribution problem with a network analyzer," which appeared in the February issue of GAS (pages 45-50), may have led to a misinterpretation of the illustration it was used to identify.

Appearing above the full-page system map of Findlay, the caption read, "Relationship of the area analyzed to the entire Findlay system." A better title would have been, "Map of the Findlay analysis, with rectangle indicating the portion treated in detail in Fig. 2 to 4."

As readers of the article noted, the entire system was analyzed, but only the portion shown in the small rectangle was treated in a step-by-step manner in the article. The tabulation of man-hours on page 48 related to the solving of the entire problem, not to the small area treated in detail.

Next job is only *minutes* away with rubber-tired Trenchmobile®

Mobility on rubber is the answer to widely-scattered trenching jobs around town, and in outlying suburban areas. A job 6 miles away can be started in less than 30 minutes from "now", with a Parsons Trenchmobile. This mobile, rubber-tired trencher runs anywhere at a moment's notice. It drives cross-town, through traffic at 12.6 m.p.h. — digs the trench at speeds up to 14½ feet per minute — drives on to next job. No waiting for trailer — no loading or unloading delays.

Digs 8 to 16 inches wide

Trenchmobile maintains fast "work-and-run" schedules on residential service connections, does pipe reclamation, trouble-shooting — is big enough, too, for main line extensions. You get trench widths from 8 to 16 inches — depths to 5 feet.

Positive down-crowd boom starts cut fast, maintains accurate grade. Self-sharpening "Tap-In" teeth assure top digging efficiency at every depth, width, and in all soil conditions. Hinged crumber sweeps trench bottom clean, ready for pipe. Sloping ladder boom also undercuts walks, curbs, gutters, cross-pipes — makes vertical set-ins. Shiftable, reversible conveyor places spoil bank on either side of trench — lets you work close to buildings, poles, without swerving from grade line.

Backfills its own trench

With 6-foot backfill blade (optional) Trenchmobile does many jobs with one-man, one-machine economy. Better see your Parsons distributor about it, or write us today. Also check Parsons 5 big, crawler-mounted Trenchliners®.

P553 GAS

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Send us latest bulletin on rubber-tired 88 Trenchmobile.

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Ruud's home laundry show launches second year

To paint a graphic picture of the need for upgraded full-input gas water heaters and gas dryers in the modern home automatic laundry, the Ruud home laundry show has taken to the road for the second year.

This unique 90-minute performance staged by Ruud Manufacturing Co. is made available to gas utilities, LPG distributors, and other interested organizations across the country. In 1954, it played 35 cities before audiences totalling 8000 persons and upwards.

Message of the show, driven home by actual demonstrations before gas company salesmen, plumbing and appliance dealers, architects, builders, and the general public, is that top-standard full-input gas equipment is a vital necessity for high-temperature water requirements in the millions of homes that have, or will have, modern automatic washers.

The first Ruud home laundry shows for 1955 were presented in Charleston and Huntington, W. Va; St. Louis, Mo. Upcoming dates already scheduled include: Portland, Maine, for the Suburban UDI Co., April 6-7; and Indianapolis, for the Citizens' Gas Co., April 9-10. Many other presentations are scheduled tentatively, including cities in Massachusetts, New Jersey, Oklahoma and Texas.

Further information can be procured by writing Ruud Manufacturing Co., 2025 Factory St., Kalamazoo 24F, Mich.

Indirect water heaters have code of outputs

The industry's first codes for determining the outputs of indirect water heaters are available from the Institute of Boiler and Radiator Manufacturers, 608 Fifth Ave., New York.

Ratings based on tests carried out under either of the two codes will be known as I=W=H Ratings, a new term applied to approved indirect water heaters of either the internal or external types. The codes were designed to provide standard and universally accepted procedures for testing and dating the output of indirect water heaters.

The first of the two codes, dated March 1, 1955, provides for I=W=H Ratings for indirect water heaters of the external or internal tankless type used in combination with specific boilers. The second I=W=H Code is intended primarily for indirect water heater manufacturers producing units of the external type, storage or tankless.

SEC's reorganization fee authority upheld by Court

SEC's authority to reduce the size of a fee incurred in reorganization of a utility has been upheld by the Supreme Court. The court reversed by a 6-to-2 vote a Second Circuit Court of Appeals ruling that the SEC lacked jurisdiction over a $100,000 legal fee claimed from Electric Bond & Share Co. by Drexel & Co., an investment banking firm.

In the fee case, the SEC ordered the charge reduced from $100,000 to $50,000, payment for services rendered to Electric Bond during the reorganization in 1948 of Electric Power & Light Corp., a former Electric Bond subsidiary. Electric Bond was to make the payment.

The SEC appealed the lower court ruling to the Supreme Court. The lower court conceded that SEC has jurisdiction over fees "in connection with" any reorganization of a holding company but held the fee to be paid Drexel by Electric Bond was not "in connection" with Electric Power & Light's reorganization.

In the opinion, written by Justice Douglas, the high court said that "payment of excessive fees was one of the

Reynolds OFFERS A NEW PERFECTED SAFETY CONTROL FOR ALL SERVICE REGULATORS

Reynolds' new Safety Control may be attached to any Reynolds spring type service regulator built in the last fifteen years.

GAS CONTROL SINCE 1892

✻ **Prevent regulator from falling in a wide open position, thus limiting the amount of gas the safety seal has to pass.**

✻ **Enable the gas company to set the regulator for a certain demand and if a customer increases that, his outlet pressure would drop which would cause him to call the company and they can find out what his real demands are.**

REYNOLDS GAS REGULATOR CO.
ANDERSON, INDIANA

historic abuses of the reorganization procedure, whereby utility companies were milked, an abuse the Public Utility Holding Company Act sought to correct."

Industrial fuel use reaching record proportions

The use of natural gas as both a bulk fuel and a precision tool of industry has reach record proportions, it is reported by GAMA.

Utilities now deliver natural gas to more than 82,000 industrial customers as compared with only 22,000 in 1932, the year gas started contending seriously for the industrial market. Adding the industries employing manufactured, mixed and other gases, the present total is 111,400, and the rate of growth, the trade group said, continues to increase.

Since 1932 industrial consumption of gas has moved from 4½ trillion therms to nearly 33 trillion, and utility revenue from this source has risen from $90,674,000 to more than $800 million. The increase from 1953 to 1954 alone amounted to 8%.

Wisconsin PSC orders Milwaukee to reduce rates

Wisconsin's PSC has issued an order directing Milwaukee (Wis.) Gas Light Co. to refund $2,780,000 to its customers and to reduce its rates by $1,262,000 a year.

Calling the company's rates "excessive and unreasonable," the commission said that they exceed the cost of service by $1,262,000. To insure prompt payment of refunds, the Milwaukee company was ordered to place in escrow all refunds received by its from Michigan-Wisconsin Pipe Line Co., its supplier.

Appliance shipments show predicted gains in January

Shipments of gas-fired furnaces, domestic gas ranges, and gas water heaters all showed significant gains during January, according to GAMA report.

Furnaces jumped 51% compared to 1954—from 31,000 to 46,800. Boilers during the same time increased by 10.3% for a total of 3200. Conversion burners, however, were off, with 5200 units this January compared to 8800 last year.

A total of 155,100 ranges were shipped in the first month this year, compared to 137,000 for a 13.2% gain.

There was a 20.6% increase in January 1955 in the number of water heaters going out, when 198,300 units were shipped compared to 164,400 last year.

"Best machine yet" says district manager of company using Clevelands for 29 years

OKLAHOMA NATURAL GAS CO. bought its first Cleveland "Baby Digger" back in 1926 and since then has continually used Cleveland trenchers throughout its system. The Company is currently keeping 10 Clevelands busy on distribution work.

Typical of the hundreds of jobs Clevelands have done for this owner is the one pictured above in Bristow, Okla. This job called for 800 feet of trench, 30 inches deep by 14 inches wide, for the rebuilding of a main under an asphalt-surfaced street and through shale, in the middle of winter. The "Baby Digger" easily cut the required trench—right on schedule—in spite of the combination of adverse conditions.

Commenting on the Cleveland's performance, O. M. Heartwill, manager at Bristow for Oklahoma Natural Gas Co., put it tersely, "Best machine yet."

Performance like this is *not* extraordinary for Clevelands—it's *expected* of them. Their quality construction, maneuverability, compactness, dependability and all around dig-ability have made them standard equipment for the gas industry for more than 30 years. It's a record worthy of your consideration.

See your local distributor for the full Cleveland story or write direct to:

THE CLEVELAND TRENCHER COMPANY • 20100 St. Clair Ave., Cleveland 17, Ohio

CLEVELAND

YOU NEED

PROTECTO WRAP...

FOR THE FAST, EASY AND ECONOMICAL COATING OF FIELD JOINTS, GAS SERVICE FITTINGS AND MECHANICAL COUPLINGS

PROTECTO WRAP is a hot applied protective coating in roll form for field joints on mill or yardcoated pipe, fittings, couplings and other metal surfaces exposed to above and below ground corrosion.

PROTECTO WRAP consists of a plasticized coal tar or asphalt enamel, of the types used for pipeline coating, saturated into a glass fabric that acts as a carrier and reinforcement for the enamel. PROTECTO WRAP is interwoven with a paper separator that insures even distribution of the coating as well as easy unwinding, regardless of temperature. The material is used to coat mteal surfaces where the quality of hot applied reinforced bituminous coating is desired.

PROTECTO WRAP is available in 2, 4 and 6 inch widths, fifty feet in length; and in 18 and 24 inch widths, 30 feet in length.

Our sales representatives are available to demonstrate this material and method. Address your orders or inquiries to our nearest sales office or to 2255 South Delaware Street, Denver, Colorado.

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212 PRUDENTIAL BUILDING, PASADENA, CALIFORNIA
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P. O. BOX 33, KENILWORTH, NEW JERSEY
ROOM 800, 20 E. JACKSON BLVD., CHICAGO, ILLINOIS

PROTECTO WRAP COMPANY
DENVER, COLORADO

1897 1955

PIPE STOPPERS OF ALL KINDS

SAFETY GAS MAIN

STOPPER COMPANY

GOODMAN USED SINCE 1897 2" HANDLE & LOCKING SLEEVE GAS MAIN STOPPER

523 Atlantic Avenue
Brooklyn 17, N. Y.
Cable Address GASTOPPER, N. Y.

GAS news notes

Purchases of the principal assets of the Paulsen-Johnson Co. by Bryant Industrial Products Corp. of Cleveland has been announced. Paulsen-Johnson, a Cleveland firm, manufactured a line of valves and regulators. These products will be manufactured in the Bryant Industrial plant at 17700 Miles Ave.

Polyken protective tape coatings, used to prevent corrosion on the recently installed municipal gas system at Waynesboro, Ga. (see GAS, October 1954, p. 67), is performing the same job on a similar system at the nearby city of Wrens, Ga. The pipeline installation at Wrens was started December 15, 1954 and is scheduled for completion this month. The total pipeline surface at Wrens will be protected by 190 linear miles of tape.

Last month, Pacific Gas & Electric Co., San Francisco, connected the three millionth customer meter to its lines. A group of company officials, including Norman R. Sutherland, vice president and general manager, and Harry A. Lee, San Francisco division manager, visited the new customer for a ceremonial installation of gas and electric services. The new homeowner was also presented with a dishwasher.

A new design, engineering, and construction organization, the Poole-Pritchard Co. Ltd., has been formed with offices in Edmonton, Alberta. The company's area of operations will be in western Canada the Great Lakes to the Pacific. The organization is a combination of the Poole Construction Co. Ltd., Edmonton, and J. F. Pritchard & Co., Kansas City, Mo.

A proposal to shorten the name of Consolidated Gas Electric Light & Power Co. of Baltimore, to Baltimore Gas & Electric Co. is expected to be submitted to the board of directors when they meet this month.

The National Safety Council has added a giant-size accident prevention banner to its stable of safety training aids. The new banners, measuring 10 ft long by 3½ ft deep and printed in two colors, point up practical safety slogans with attention-getting drawings. They are available for indoor or outdoor display.

The New York PSC gave Niagara Mohawk Power Corp. permission to construct a gas plant in Minoa, Onondaga county, and to exercise a gas distribution franchise granted it by the

Minoa Village board. It is expected there will be about 120 gas customers served by the end of the first year of operations there, with the total increasing to 275 within three years.

Lew Bonn Co., Minneapolis, has been appointed Servel home appliance distributors. The company's territory includes 23 counties in northwestern Wisconsin, most of Minnesota, except six counties, all of North Dakota, and sections of Iowa and South Dakota.

Penn Industrial Instrument Corp. Philadelphia, by corporate merger has become a division of Burgess-Manning Co., Libertyville, Ill. and Dallas.

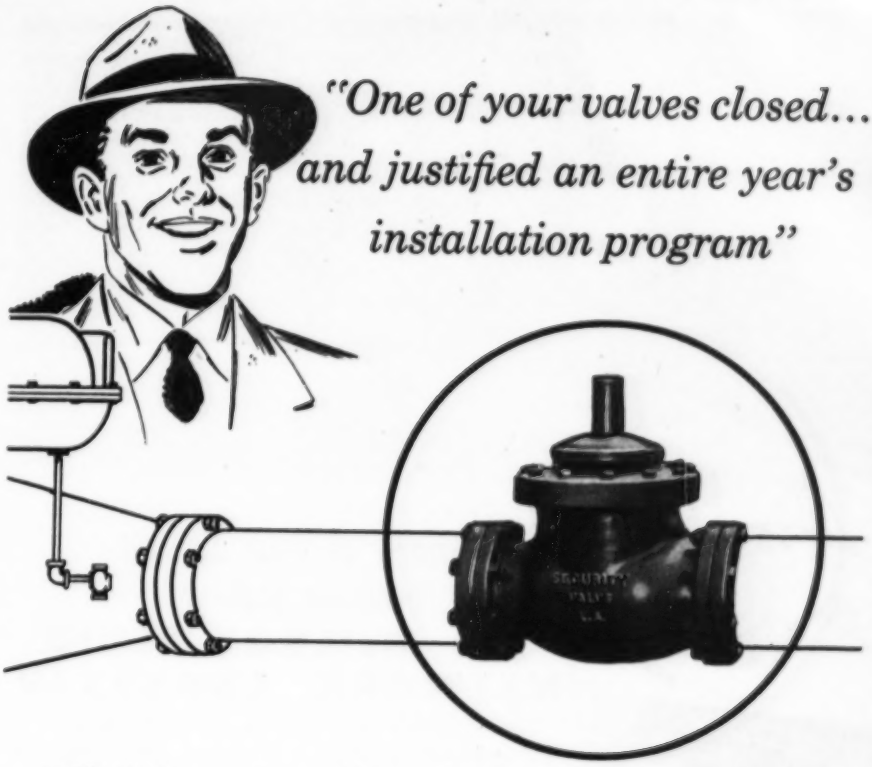
Penn instruments will continue to be manufactured at the Penn plant, 4110 Haverford Ave., Philadelphia. William C. Bennett, formerly president of Penn, has been elected vice president and director of Burgess-Manning and will manage the new division.

The Natural Gasoline Association of America has published a revised edition of its publication 2145, "Physical Constants for the Paraffin Hydrocarbons and other Components Associated with Natural Gas." Arranged in a four-page, 8½ x 11 in. folder, punched for standard ring binders, the table presents all the values commonly used in the analytical and engineering computations at natural gasoline plants. Copies of the table are available from NGAA, 421 Kennedy Bldg., Tulsa.

A 17% price reduction on plastic pipe has been made by Carlon Products Corp., manufacturers of extruded plastics, Cleveland, Ohio. Brigham Britton, president of Carlon, credits the price reduction to a drop in material costs and savings in manufacturing, which are being passed on to users.

Pennsylvania's Public Utility Commission would be required to hold public hearings in all rate cases under terms of a bill introduced in the Pennsylvania Legislature by Senators W. J. Lane of Washington and John J. Haluska of Cambria, both Democrats. Under present law, hearings are conducted at the PUC's discretion.

The Montana senate has given a tentative okay to a bill allowing the state to lease depleted gas areas to public utilities for storage of gas for a period of 20 years. Sen. H. H. Anderson asked Rex Hibbs, chairman of the oils and leases committee, whether such leasing would not delay the development of natural gas in Montana by pumping in natural gas from other states. Hibbs said Montana does not now produce as much natural gas as its citizens consume.



"One of your valves closed... and justified an entire year's installation program"

■ That's the experience of just one of the major gas companies and gas-using industries from coast to coast who have standardized on Security Automatic Shut-Off Valves. Because of their *absolute* protection against overpressuring, the operation of a single Security Valve can pay for a system-wide installation.

Security Valves are positive and always dependable . . . they are engineered for one specific function. Vital in congested areas, they eliminate both the expense and hazard created by high-capacity vent lines necessary when other over-pressure protection devices are employed.

A *complete* line, Security Automatic Shut-Off Valves are available in sizes ¾" to 12" for use on lines operating on inches water column to 1500 psig. They can be installed up or downstream of the regulator and controlled directly or by means of a pilot line.

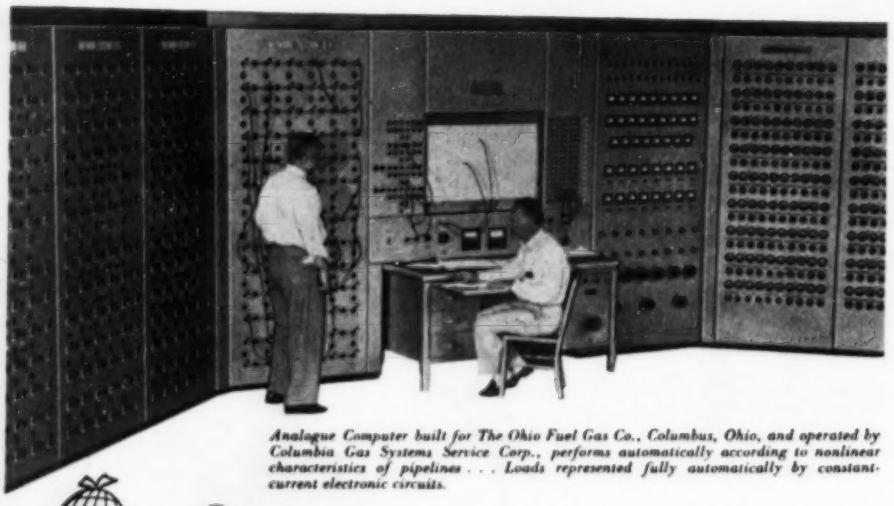
Security Automatic Shut-Off Valves range from ¾" for domestic lines (right) to large distribution line sizes (above).

Nationwide representation insures fast help on your gas safety problems. Write today for the complete story and specifications of Security Valves.

SECURITY VALVE

SECURITY VALVE CORP.

541 W. GARFIELD AVENUE • GLENDALE 4, CALIF.

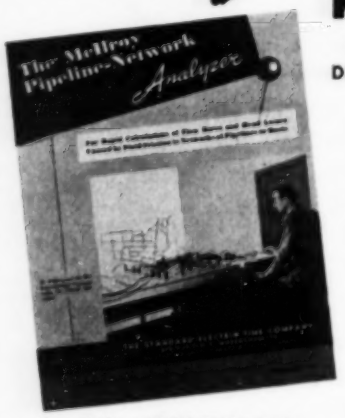


Analogue Computer built for The Ohio Fuel Gas Co., Columbus, Ohio, and operated by Columbia Gas Systems Service Corp., performs automatically according to nonlinear characteristics of pipelines . . . Loads represented fully automatically by constant-current electronic circuits.

Solve many of your difficult pressure problems

The McILROY FLUID NETWORK ANALYZER

Gives Immediate, Accurate Data, Quickly Solves Many Difficult Pressure Problems in Distribution and Transmission



Gas engineers will welcome the accurate data supplied automatically by the Analyzer, because with it they can decide with authority many baffling questions . . . The Analyzer is adjustable for all operating conditions . . . represents with satisfactory engineering accuracy operation of gas pipelines according to the Spitzglass, Weymouth, Panhandle, and other gas-flow formulas at low, intermediate, or high pressure . . . Solutions given for both compressible and incompressible fluids.

Send for BULLETIN 183

Your files should contain all available data on this very important development.

Since STANDARD *1884*

The STANDARD ELECTRIC TIME CO.

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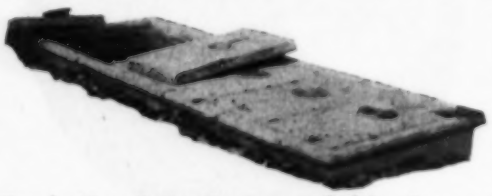
ELECTRIC CLOCK AND PROGRAM SYSTEMS • FIRE ALARM SYSTEMS • HOSPITAL SIGNAL SYSTEMS
PRECISION TIMERS • CHRONO-TACHOMETERS



Meet the latest expandable type of curb meter box, the Forni type P. A.

• *Write For Details and Samples*

GEORGE P. FORNI CO.

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Also Manufactured Pre-Cast Regulator Pits and Sidewalk and Traffic Type Valve Boxes

Some of Its Outstanding Features:

1. Simplicity in design—three different pieces make any size unit.
2. Strong, rigid, construction —all pieces completey reinforced.
3. Tripping hazard eliminated because of recessed cover —box can be leveled to sidewalk grade without cover in place.
4. Meter sets kept cleaner—concrete bottom cast as an integral part of box sides.
5. Ample room in box to service meters or exchange for larger size meter.

GAS calendar

April

28-1..Western Metals Congress and Exposition—Los Angeles.

7..Southeastern Gas Association Sales & Advertising Roundtable Conference — Selwyn Hotel, Charlotte, N. C.

12-14..AGA Sales Conference on Industrial & Commercial Gas —Hotel Statler, Boston.

12-15..AGA Distribution, Motor Vehicles & Corrosion Conference — Netherland Plaza, Cincinnati.

13-15..NGAA 34th Annual Convention — Baker and Adolphus Hotels, Dallas.

14..GAMA Sixth Annual Automatic Gas Range Conference —Hotel Pierre, New York.

14..Southeastern Gas Association Supervisory Training Roundtable Conference — Wade Hampton Hotel, Columbia, S. C.

18-19..AGA Residential Gas Section, Eastern Natural Gas Regional Sales Conference—Hotel William Penn, Pittsburgh.

19-20..PCGA Distribution Conference—Phoenix, Ariz.

19-21..Southwestern Gas Measurement Short Course—University of Oklahoma, Norman.

20-22..Indiana Gas Association Annual Meeting — French Lick Springs Hotel, French Lick, Ind.

25-27..National Conference of Electric and Gas Utility Accountants — Conrad Hilton Hotel, Chicago.

25-27..Mid-West Regional Gas Sales Conference—Edgewater Beach Hotel, Chicago.

27..PCGA Non-Residential Sales Clinic — Los Angeles.

28..PCGA Residential Sales Clinic — Los Angeles.

27-28..AGA Research & Utilization Conference — Hotel Statler, Cleveland.

28..Southeastern Gas Association Transmission & Distribution Roundtable Conference — Selwyn Hotel, Charlotte, N. C.

May

1-4..LPGA Annual Convention—Conrad Hilton Hotel, Chicago.

2-3..Gas Compressor Institute (University of Kansas & Southwest Kansas Petroleum Industry, co-sponsors) — Legion Hall, Liberal.

2-6..AGA Industrial Gas School—Hotel William Penn, Pittsburgh.

9-10..AGA Gas Supply, Transmission & Storage Conference—William Penn Hotel, Pittsburgh

11-12..PCGA Transmission Conference — Palm Springs.

12-13..Public Utilities Advertising Association—Sheraton Hotel, Chicago.

16-18..Southern Gas Association — New Orleans.

17-19..Pennsylvania Gas Association —Pocono Manor Inn, Pocono Manor, Pa.

23-24..AGA Residential Gas Section New York - New Jersey Regional Gas Sales Conference — Hotel Commodore, New York.

23-25..AGA Chemical, Engineering & Manufactured Gas Production Conference — Hotel New Yorker, New York.

June

1-2..Tenth Annual Short Course in Gas Technology — Texas College of Arts & Industries, Kingsville, Texas.

5-9..Canadian Gas Association Annual Meeting—Sheraton-Brock Hotel, Niagara Falls, Ontario.

7-9..Mid-West Gas Association Gas School & Conference — Iowa State College, Ames.

9-10..Natural Gas & Petroleum Association of Canada — Royal Connaught Hotel, Hamilton, Ontario.

27-28..Michigan Gas Association—Grand Hotel, Macinac Island, Mich.

September

9..New Jersey Gas Association —Hotel Monmouth, Spring Lake, N. J.

11-13..INGAA Annual Meeting — Jasper Lodge, Alberta.

27-30..International Gas Union 6th Conference — Hotel New Yorker, New York.

October

12-14..GAMA Annual Meeting — El Mirador Hotel, Palm Springs, Calif.

17-19..1955 AGA and PCGA Convention—Los Angeles.

WRIST-ACTION HYDROHOE SPEEDS TRENCHING Hydrohoe wrist-action dipper is hinged at lower end of dipper handle and rotates a distance of 65 degrees. Result is bigger loads, cleaner trenches, more biting force, less spillage. Available in 12, 18, and 24-in. widths. Hoe has same precision control, boom telescope, and smooth action as Hydrocrane. Quickly convertible to crane boom in the field.

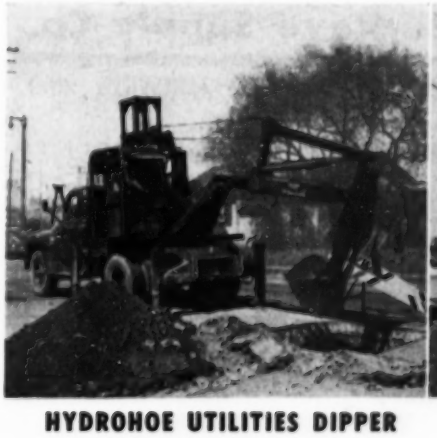
EXTRA ATTACHMENTS Multiply Gas-Job Value of Hydrocrane-Hydrohoe

Extra attachments, designed particularly for gas jobs, make the all-hydraulic Bucyrus-Erie Crane-Hoe an even greater favorite among utilities. They not only speed specialized digging and repair jobs, but are equipped with quick-change fittings—attachments can be switched in a few minutes.

Your Bucyrus-Erie distributor will demonstrate the all-hydraulic Hydrohoe or Hydrocrane—show you how these custom-matched attachments can save time and money. Complete literature is yours for the asking. Write today. 75H55

BUCYRUS-ERIE COMPANY
South Milwaukee, Wisconsin

BUCYRUS ERIE

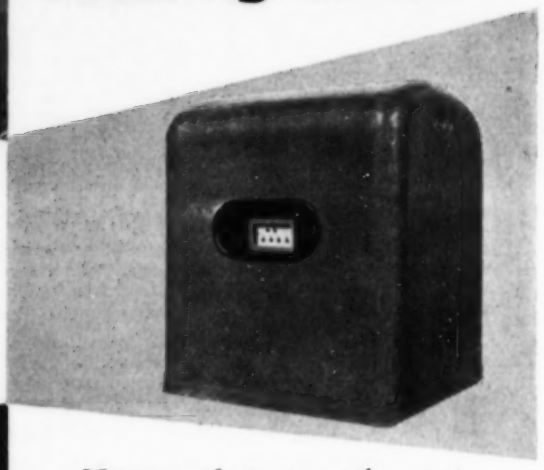


HYDROHOE UTILITIES DIPPER
Tailor-made for gas users, this new 20-in. wide, wrist-action dipper is especially designed for digging holes of greater depth than length. Dipper rotates 95° from 45° behind handle to 50° ahead. Here is an invaluable attachment for digging manholes, valve pits, uncovering pipe leaks.

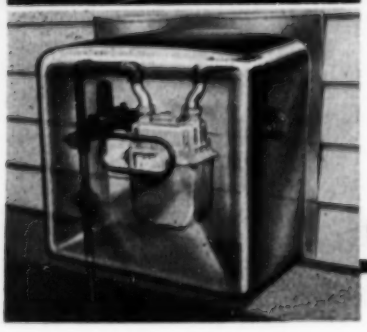
NEW ⅜-YD. CLAMSHELL BUCKET
Long, sharp teeth quickly knife into tough clay and hardpan. Smooth clean bowls shed sticky dirt in a hurry. Bucket closes by two hydraulically operated rams. Use of twin rams instead of single center ram provides 42 per cent more force to lips at point of closing. Bucket cleaner optional.

Meter Dome

solves housing problems, cuts reading costs



Yard model (right) sits directly on ground, with no rot or corrosion danger. Can be fastened to stakes. Wall model (above) has slots in flange, slips over screws.



Meter readers can make up to twice as many calls per day when sets are outside, and protected by a genuine one-piece Fiberglas Meter Dome. Emergency shut-offs are quicker, servicing is easier, annual painting is unnecessary, and installations are more economical.

Get the complete story today on money-saving plastic Meter Dome. It's your best buy in the meter cover field.

Transparent models (left) show roominess of Meter Domes. Either one easily holds any size domestic meter, meter bar and regulator.

the Buckeye Supply Co.

18 HARRISON AVE. • ZANESVILLE, OHIO

TERRITORIES AVAILABLE FOR MANUFACTURER'S AGENTS

MECHANICAL JOINT ACCESSORIES

Malleable Iron Follower Glands

Strong — Corrosion Resistant — Light Weight — Sizes 2" thru 12"

High Strength Cast Iron Tee Head Bolts and Nuts

Write for Information and Prices to:

CADILLAC CAST PARTS CO.

Subsidiary of
Cadillac Malleable Iron Co.
Cadillac, Michigan

GAS

associations

Distribution conference set for Cincinnati

The AGA distribution, motor vehicles and corrosion conference, April 12-15 at the Netherland Plaza hotel in Cincinnati, will feature general sessions during the first three mornings of the meeting. In addition, there will be luncheon conferences each day and special sessions in the afternoons.

At the first general session, Tuesday morning, F. G. Sandstrom, Consolidated Edison Co. of New York, will moderate a panel discussion built about the B31 code. The panel will discuss the development of the code and its effects on design and installation of the gas distribution system, on methods and equipment to prevent over-pressuring, and on operating and maintenance procedures; a discussion of interpretations and revisions of the code will follow.

Tuesday luncheon conferences will be devoted to customer service and distribution design and development. The automotive and mobile equipment session will occupy the afternoon spot.

On Wednesday, the general session will have talks on cutting costs in distribution department work, protection of distribution systems, a modern method of service analysis, and installation, operating and maintenance of service-type regulators. Sessions will be held Wednesday morning and afternoon on automotive and mobile equipment.

Wednesday luncheon conferences will be on construction and maintenance, converting size and type of property, general supervision and manpower; scope of work, type of personnel and equipment used, and general methods of work planning and accomplishment; on corrosion, covering such subjects as corrosion mitigation practices, sacrificial anodes, rectifiers, protective coatings, insulation, and interference; on metering, covering the meterman's responsibility, meter capacities; diaphragms, and meters and service type regulators.

Thursday's general session will cover methods to prevent overpressure in distribution systems, meter shop design and operation under an incentive wage

rate, and the service department. The corrosion session on Thursday morning will cover such subjects as surface methods of attaching anodes to pipelines, economics of a paint survey, surface potential measurements, and causes of ferrous pipe corrosion.

In addition to a symposium and demonstration of corrosion instruments at a Thursday luncheon conference, other conferences will be held on customer service and distribution design and development. The latter will feature a panel discussion of distribution system network analysis.

Friday morning's open sessions will be on automotive and mobile equipment, construction and maintenance, corrosion mitigation, and metering. The plastic pipe standards session will be held Friday afternoon.

Natural gasoline men to meet in Dallas

The 34th annual convention of the Natural Gasoline Association of America will convene April 13-15 at the Baker and Adolphus hotels in Dallas.

Forums during the three-day meeting will cover such subjects as absorption, LPG, corrosion, equilibrium constants, economics, and petrochemicals.

General sessions will feature discussions of LPG sales, employee relations, and presentation of the Hanlon award. In addition, John F. Merriam, president of Northern Natural Gas Co., will discuss FPC regulation.

Preliminaray plans made for SGA's May convention

New Orleans will put on its best spring dress May 16-18 to welcome the Southern Gas Association's 47th annual convention. Two thousand delegates and visitors are expected to register for the three days of education, inspiration and entertainment.

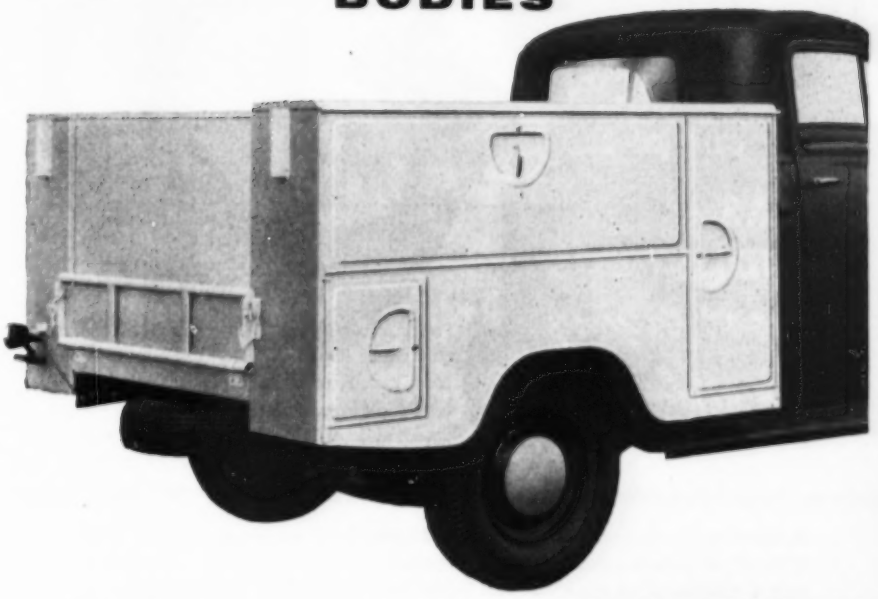
There'll be addresses by experts in business and economics, reports on various phases of the natural gas industry by experts from many sections, and a peek at the future through some highly reliable crystal balls.

The big entertainment feature will be presented in true New Orleans style. Gas appliance manufacturers, for their annual Friendship Hour, have chartered the S. S. President for an evening cruise up and down the Mississippi to the accompaniment of melodious music, tinkling glasses and a bounteous buffet.

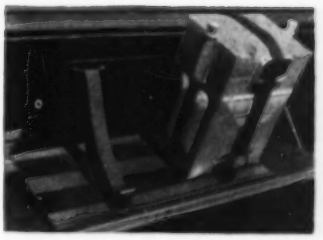
A unique feature for the ladies will be luncheon on Tuesday, May 17, at Diamond Jim's La Louisiane restaurant, when Diamond Jim will be decked out in all his diamonds. Mrs. J. H. Collins Sr., wife of the SGA's first vice presi-

Completely NEW . . . for Gas Utilities

Meter Installation and General Service BODIES



● **Morrison's new gas utility Service Bodies and Accessories give your trucks a clean, neat appearance . . . provide maximum safety for crew and equipment . . . feature a compact design with more useable carrying space and a time-saving accessibility to tools, parts and supplies.**



With models to fit 40 different ½ - ¾ - 1 and 1½-ton, single or dual wheel chassis . . . 18 possible compartment arrangements . . . completely weatherproof compartments . . . and more than 20 other new design and construction features, Morrison Service Bodies are engineered and built to specific requirements of gas utilities, according to their recommended specifications.

Morrison Service Bodies and Accessories can completely equip any truck for any job. For meter installation and service there are Meter Trays for both horizontal and vertical compartments. They are equipped with necessary padding and hold-down straps which clamp the meter securely in place without sacrificing easy access for loading and unloading. Other available optional equipment includes material trays, pipe racks, forward pipe rest, rear mounted pipe vise bracket and rear bumper step.

In all phases of gas service work, Morrison Service Bodies and Accessories can help you promote crew efficiency and cut operating costs. Complete information on the entire line is available on request.

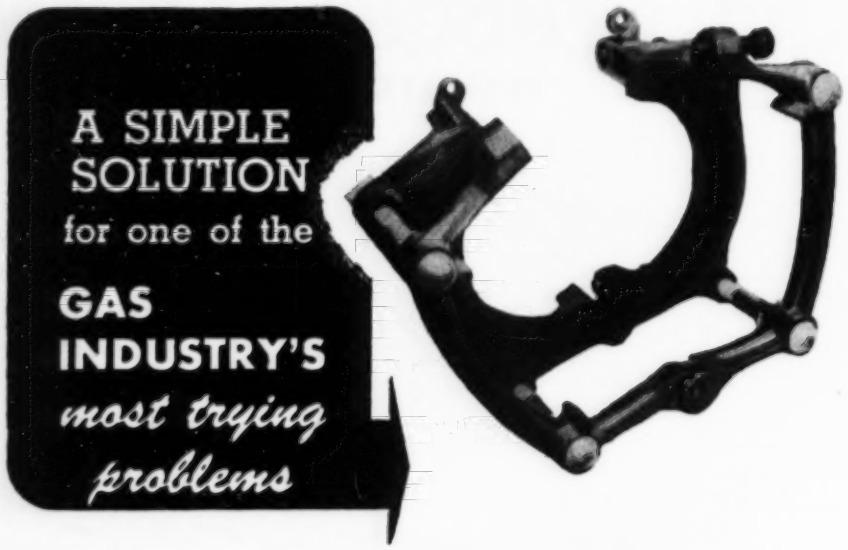
For Better Service and Greater Utility . . . Specify

Morrison service bodies

Morrison Service Body Division

MORRISON STEEL PRODUCTS, INC. • 696 Amherst St. • Buffalo 7, N. Y.

THE NORMAC BELL JOINT CLAMP



Solves Your Joint Repair Problems • Quick • Easy • Permanent

Installed in small pavement openings. Available in all standard sizes from 3" to 12". A simple set of tools cleans the joint, installs the clamp . . . often in only a quarter of an hour. SAVES TIME, SAVES MONEY and the repair is permanent. Designed for all conditions particularly where pavement repair costs are prohibitive. Such small opening repairs are scarcely noticeable when pavement is replaced.

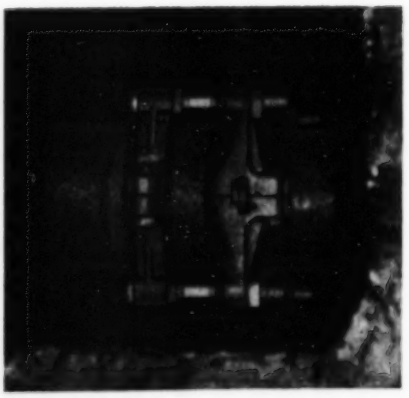
Normac Clamps can be installed in large as well as small openings.

Norton-McMurray hold definite leadership in the development of methods for installation and rehabilitation work through small openings. We welcome the opportunity to help solve a problem you may have—tell us about it.

Write for our catalog describing our complete line of

COUPLINGS . . . FITTINGS . . . SERVICE TEES and ELLS . . . SLEEVES . . . COMPRESSION-END COCKS . . . METER BARS and BRASS FITTINGS for copper pipe.

6 inch Normac Clamp being lowered into hole for installation



6 inch Normac Clamp in service after installation

NORTON-McMURRAY MFG. CO.

122 SOUTH MICHIGAN AVENUE • CHICAGO 3, ILLINOIS

Method and product covered by U. S. Patents, Nos. 2,163,261 and 2,178,286.

dent, is chairman of entertainment for the ladies.

Thad W. Rowden Jr., Arkansas Western Gas Co., Fayetteville, is this year's general convention chairman. General vice chairmen are L. A. Bickel, Lone Star Gas Co., Dallas, for the companies, and Ernest G. Hotze of Clark Bros. Co. division, Dresser Industries, Houston, for the manufacturers.

AGA releases general plan for Los Angeles convention

Plans are progressing rapidly for the first AGA convention on the Pacific Coast, according to R. R. Blackburn, vice president, Southern California Gas Co. and chairman of the 1955 AGA convention committee. The 37th annual convention will be held jointly with the Pacific Coast Gas Association's 62nd annual convention Oct. 17-19 at Los Angeles.

General sessions meetings will be held at the Statler hotel, which also has been designated as headquarters for the general management and the accounting sections of AGA. The residential gas, and the industrial and commercial gas sections will hold meetings and maintain headquarters at the Ambassador hotel. The operating section will establish its headquarters and hold its meetings at the Biltmore hotel.

A committee headed by Robert A. Hornby, executive vice president of Pacific Lighting Corp., is arranging a program of stimulating and informative meetings with talented speakers. These meetings include the general sessions, sectional programs and the joint PCGA-AGA luncheon meeting on Oct. 19.

Boston site of industrial, commercial sales meeting

The 1955 AGA sales conference on industrial and commercial gas will be held in Boston at the Hotel Statler, April 12-14.

Following the pattern of previous years, the three-day conference will have commercial gas day on Tuesday, April 12, a general session on Wednesday, and finishing up with industrial gas day on Thursday, April 14.

Leading off with a most important subject, "Gas Fryers Have Got It!", Jim Condon of Peoples Gas, Chicago, will sound the keynote for one of several interesting panel discussions.

Other subjects to be covered by panel groups include commercial incineration, water heating, and air conditioning, and the selection and training of commercial and industrial manpower.

International oil show to attract 350 exhibitors

More than 350 exhibitors will feature the most modern developments in exploration, drilling, transportation, and processing methods and equipment for the petroleum industry at the International Oil Exposition in Houston, May 3-8.

In the newly air-conditioned Sam Houston Coliseum and adjoining outdoor areas will appear such updated items as the latest in portable drilling rigs, swamp buggies, offshore installations, geophysical instruments and hundreds of other kinds of equipment which make the oil industry the competitive business it has become and continues to be.

Admission to the exposition is free by invitation to men and women in all branches of the oil industry, who will obtain their tickets from manufacturing plants or by writing directly to the exposition, 1416 Melrose Bldg., Houston.

PUAA's annual convention to cover wide range

The advance program for the forthcoming national convention of the Public Utilities Advertising Association contains such topics as "financial aspects of utilities," "the advertising staff and the public," "motion pictures in business." The convention is scheduled for May 12-13 at the Sheraton hotel in Chicago.

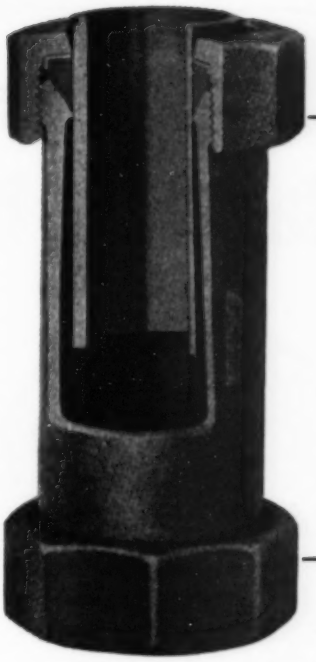
All of the winners of the "Better Copy" contest will be on view and there will be an exhibit of the top national employee publications shown by the Industrial Editors Association.

Additional topics scheduled for discussion by top authorities include good poster copy, public relations—problems and solutions, gas promotion at the local level, a national appliance program, motivation studies—why people buy, television, advertising, direct mail, and cost analysis.

Plans made for participation in Nevada atomic tests

Objectives of AGA participation in the atomic tests scheduled for Nevada this month are to determine the effects of ground shock, and atmospheric overpressure and elevated temperature on typical gas industry installations as a result of atomic explosions.

Included in the test would be underground gas mains, underground vaults and pits containing pressure regulators and valves, service piping, house meters and piping, domestic gas burning appliances and emergency gas repair and re-



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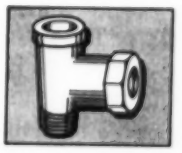
Couplings, Sleeves and Fittings

for maximum deflection, ease of "stabbing," complete confinement of the rubber!

So close are "Normac" rubbers confined at the gasket tip that possibility of flow is reduced almost to "nil." These couplings, sleeves and fittings . . . approved by gas utility men across the country for their time-saving features, ease of handling and dependable service . . . are available in a complete range of sizes. Made from air furnace malleable iron they provide greater wall thickness than pipe on which used.

NORMAC COUPLINGS are made with 5" centers in all sizes. NORMAC SLEEVES are identical in design except that they are made with 10" centers. Nuts and gaskets are interchangeable.



Compression-End Service "Tee"—First fitting of this type ever produced with full coupling depth and special threads on male end to prevent dropping into old hand taps when used to replace standard threaded fittings.

Compression-End Service "Ell" — Extra depth makes it possible to "stab" pipe into stops and without measuring, pull back a safe distance to allow ultimate deflection eliminating possibility of strain against tap in main.

Compression-End Iron Body Brass Core Service Stopcocks—End the necessity of threading on the job plus the elimination of the threads themselves—combining all the advantages of NORMAC COUPLINGS and the best in stopcock design. 2½" coupling depth on each end.

Normac Brass Fittings Developed in 1939 for Use with Copper Tubing—Our complete line of brass fittings can be used either on new installations or where copper is run through old steel pipe in large or small openings. The center to end dimensions of NORMAC TEES correspond with old malleable iron fittings. This feature is extremely important in the use of these fittings in one foot openings where the tubing must line up with the steel which has been removed.

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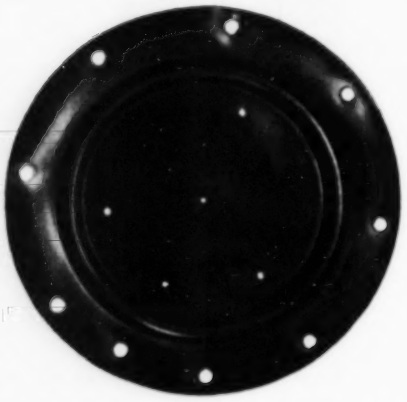

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Write for our new catalog "Industrial Coated Fabrics." We are prepared to quote against customer's blueprints on all types of molded diaphragms.

For the finest pressure regulation and most sensitive control specify Haartz-Mason diaphragms.

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placement equipment on trucks.

A subcommittee on atomic test has been appointed by the AGA to act as the executing agency for the association. This committee included John J. Novy, Peoples Gas Light, chairman; C. George Segeler, AGA; James F. Bell, Portland Gas & Coke; Donald S. Bittinger, Washington Gas Light; Baxter D. Goodrich, Texas Eastern Transmission; H. G. Laub, Nevada Southern Gas; and H. L. Masser, Southern California Gas. Harold Massey, GAMA, is a member of the committee and has acted as liaison officer in obtaining equipment for the test.

Guy Corfield, SoCal, is chief project officer; Mr. Laub and H. E. Ferguson, Peoples Gas Light, are deputy project officers.

In an interim report to the gas industry, Mr. Corfield advised that a two-story and basement house of brick and cinder blocks will be erected at the test site. The house will be equipped with a gas burning range, refrigerator, clothes dryer, incinerator, water heater, and househeating unit, with an assembly of gas appliance controls. Typical distribution mains will be underground and regular house meters and house piping will be installed.

Another ranch type house, one-story high, will be constructed of wood and will be equipped similarly to the two-story brick house. Two trucks will be placed in the test; a heavy repair truck and a light emergency truck. Both trucks will be completely equipped with repair and emergency equipment.

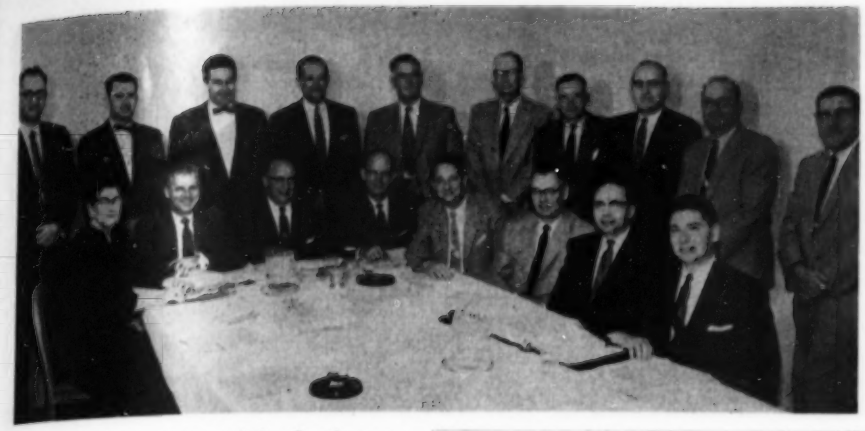
Conventional gauges will be used to test joints and connections for leaks before and after the explosions. Information on ground shock, atmospheric overpressure and elevated temperature will be available from the normal routine of the over-all test.

New GAMA members bring total to 593 companies

Six new GAMA members make a total of 593 member companies for the association whose combined membership accounts for more than 95% of all gas appliance and equipment production in the U. S.

The new members are Superbo Manufacturing Co., Los Angeles; Thermogray, Jefferson, Iowa; Westomatic Water Heater Manufacturing Co., Citra, Fla. (all water heater manufacturers).

The others are Garland Commercial Ranges Ltd., a subsidiary of the Detroit-Michigan Stove Co; Steel City Furnace Corp., Springdale, Pa.; and J. F. Winchel Co., Cleveland, Ohio (room heaters).



The general committee of the Southwestern Gas Measurement short course met recently to arrange the program for the April 19-21 session. Seated third from left is Dean W. H. Carson of the University of Oklahoma, chairman of the executive committee of the course.

Gas measurement short course marks 30th year

The Southwestern Gas Measurement Short Course will be held on the North Campus at the University of Oklahoma on April 19-21. The 1955 course will be a noteworthy occasion since this is the 30th year since the course was founded. Approximately 19,000 persons have received special instruction offered through the years by this medium.

The program consists of one general session and 21 classroom periods of 40 minutes duration with each period having seven classes running concurrently. The 91 classroom instructors will be drawn from educational institutions, industries, and manufacturers.

The principal address will be given by James E. Allison, president of the Warren Petroleum Corp. Dr. G. L. Cross, president of the University of Oklahoma, will make an address of welcome, and Dean W. H. Carson, O. U. College of Engineering and chairman of the executive committee of the course, will speak to the general assembly on the aims and operation of the course.

Inasmuch as there will be no advance registration, those who will register for the course should be present when registration starts at 8 a.m. on Tuesday morning, April 19.

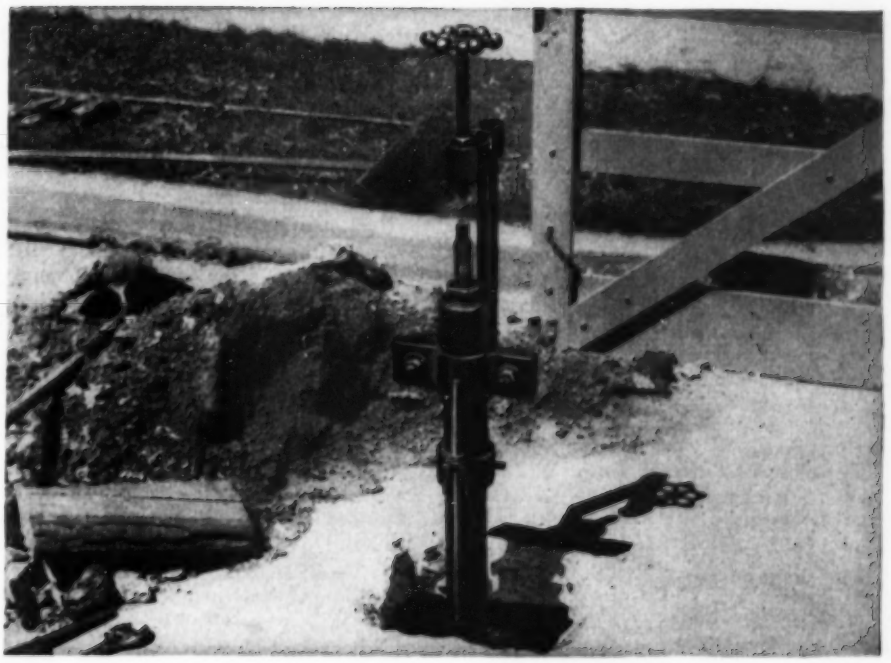
Thirty companies will have educational exhibits on display throughout the course.

Those persons wishing a copy of the program for the short course and information about hotel accommodations should write directly to Miss Kate A. Niblack, Oklahoma Utilities Association, Suite 2415, Oklahoma Biltmore hotel, Oklahoma City, Okla.

Home service workshop plays up sales promotion

More than 250 home service and sales representatives were indoctrinated on the important part home service can play in gas utility sales promotion programs at the recent Home Service Workshop held in Chicago.

Katherine L. Rathbone, Southern Counties Gas Co. and chairman of the home service committee, opened the workshop by outlining the challenge of planning home service activities in relation to today's new home construction



Modern leak control

with CARBOSEAL *Anti-Leak*

Trade-Mark

The gas company that is using this modern main-tapping device (it works through street openings only 1 foot square) has chosen the *modern* method of stopping leakage due to dried-out fiber packing—CARBOSEAL Anti-Leak.

This progressive gas company knows that CARBOSEAL Anti-Leak is:

• effective • inexpensive • lasting • easy and economical to apply

Get all the facts. Write for the booklet, Form 4506—or the 16 mm. color-sound movie, "CARBOSEAL Anti-Leak Stops Gas-Main Leakage," which will be sent to you without charge.

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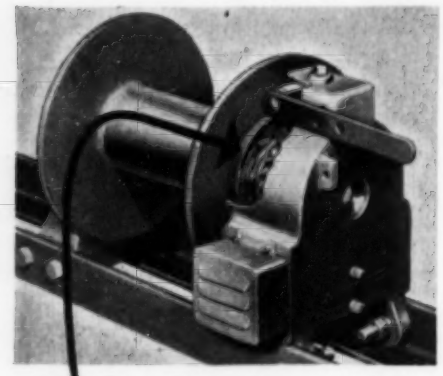
Now...a 7000-lb. winch with Big-Winch-Features



Look closely...the Secret's Inside!

Here, at last, is an improved light-duty Gar Wood winch that positively ends the old-time headaches of sticking, freezing, rusting — because all moving clutch parts are *fully enclosed and running in oil.* Neither weather nor dirt can ever get in. Your operator also has much *safer control of the load,* thanks to Gar Wood's exclusive self-energizing safety brake, and time-tested backdraft clutch, which eliminates the hazard of sudden slippage.

More GW plus values

New rust-proof aluminum housing means lighter weight, longer life... dissipates heat much faster than steel. In addition, extra rugged base angles insure a margin of safety many times the rated capacity of the winch. New "built-in" rope clamp also simplifies attaching and changing rope... eliminates U-bolts and other projections that tend to foul spooling. See these great new 7000-lb. winches - standard or low mount - at your Gar Wood distributor today.

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Gar Wood Industries, Inc.
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☐ Send free literature on new 7000-lb. Gar Wood Winch

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Program committee for the Home Service Workshop (from left): Mildred R. Clark, Tulsa; Elizabeth Lynahan, Chicago; Jessie McQueen, New York; Katherine L. Rathbone, Los Angeles; Eleanor Morrison, Grand Rapids, Mich.; Irene L. Muntz, Rochester, N. Y.; and Mary E. Huck, Columbus, Ohio.

and modernization of kitchens and laundries.

An exhibit of modern gas ranges entitled "Gas Panorama of Progress," was a new feature of the 1955 workshop. H. P. Morehouse, Public Service Electric & Gas Co., Newark, N. J., presented newest features available in 12 gas ranges on display.

Program requests contributed 12 subjects which were discussed in symposium during the three days. The subjects ranged from television shows to laundry clinics.

F. X. Mettenet, vice president, the Peoples Gas Light & Coke Co., who welcomed delegates at the opening luncheon, stressed contributions made by home service in sales programs. He emphasized need for keeping management advised on accomplishments made in home service. W. H. Kurdelski, Michigan Consolidated Gas Co., chairman of the AGA residential gas section, further developed the subject of home service participation in sales at the concluding luncheon.

Other highlights of the program were a color slide presentation of 29 new kitchens and laundries showing what is new in home service kitchens; a discussion of cooperation between service departments and home service groups for better dissemination of information on new equipment developments; a panel discussion on securing home service personnel; a competitive range demonstration; and a discussion and demonstration of the need for modern water in modern laundries.

Phillips' case results discussed by Midwest group

The second largest group in the history of the Mid-West Gas Association attended its 50th annual convention at the Hotel Saint Paul in St. Paul, Minn. Four hundred thirty-five registered for the three-day activities, which commenced on the morning of March 7.

Economic consequences of the Supreme Court's decision in the Phillips case were highlighted by Samuel B. Pettingill, former congressman from Indiana and now an a-

New and old officers of the MidWest Gas Association (from left): H. E. Peckham, Northern States Power Co., secretary-treasurer; M. K. Wrench, Metropolitan Utilities District, president; M. B. Cunningham, Iowa Power & Light Co., retiring president; George B. Johnson, Minneapolis Gas Co., 1st vice president; and P. C. DeHaan, Iowa Power & Light, 2nd vice president.

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Installing pipe underground is quick and simple this way. With a GREENLEE Hydraulic Pipe Pusher *one man* pushes pipe through the ground—under streets, railways, walks, lawns, floors. Saves time, cuts costs through elimination of extensive ditching as just a short trench accommodates the Pusher. No tearing up of pavement, lawns, floors . . . eliminates tunneling, back-filling, tamping, repaving. Cuts job time to a fraction. Pusher often pays for itself through timesavings on first job or two.

No. 790 GREENLEE PUSHER For 3/4 to 4-inch pipe. Six speeds—5,600 to 40,000 lbs. pushing pressure.

No. 795 GREENLEE PUSHER For pipe larger than 4-inch, concrete sewer pipe, large drainage ducts. Six speeds—25,000 to 150,000 lbs. pushing pressure.

POWER PUMP For both sizes of GREENLEE Pushers. Pushes pipe at rate of two feet per minute.

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Get facts on timesaving Greenlee tools now. Write Greenlee Tool Co., Division of Greenlee Bros. & Co., 1944 Columbia Avenue, Rockford, Illinois, U.S.A.

torney for the Pure Oil Co., Chicago. He predicted that as a result of the decision there will be a decline in the amount of gas moved across state lines, more northern industries will shift to the Southwest, and federal price controls over all natural resource industries may be adopted.

C. H. Zachry of Southern Union Gas Co. effectively reviewed problems facing the natural gas industry in a talk entitled "We Stand Together." Reports by committees followed, and the election of officers and new members wound up the morning program.

In a talk titled "Looking Forward," James H. Binger of Minneapolis-Honeywell Regulator Co. described the way in which electronic controls will aid in the household use of gas in the near future. New appliance developments, first announced last year, but now actually being put into production, were discussed by Edwin L. Hall, director of the AGA laboratories. Among these are a pilot light of pinhead size designed to help keep the kitchen cool in the summer, a burner the size of a nickel which can be kept low for simmering or increased to frying heat, and a griddle which is thermostatically controlled. Several of these new developments were displayed on ranges exhibited in a nearby room.

A number of helpful ideas on merchandising water heaters were given in a talk by C. H. Wilkinson, manager of the water heater sales section of Affiliated Gas Equipment Inc., Cleveland, Ohio. He discussed the relationship of the manufacturer, utility company, and the dealer to each other, and showed how they can work together to further the sale of gas by selling water heaters.

The effect of atomic weapons on gas distribution was discussed by R. C. Lisk, of Fisher Governor Co. He pointed out that, in the event of an atomic attack, gas lines would suffer less damage than power lines because of their location in the ground.

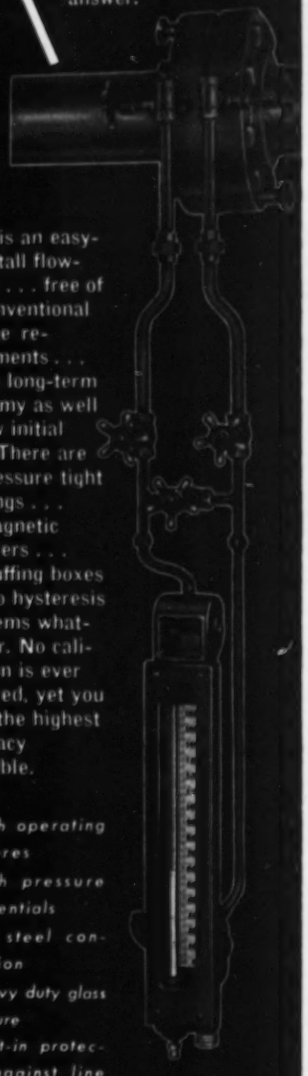
In a talk entitled "Promotion of Gas Beyond the Mains," K. R. D. Wolfe strongly advocated the cooperation of utilities with LPG dealers. Mr. Wolfe, who holds the title of chairman of the executive committee of the National Council for LP-Gas Promotion, explained the purpose and functions of this newly renamed organization. He also pointed out that by standardizing a single name for the product of the LPG industry, dealers could eliminate much of the confusion that presently exists in the public's mind as to exactly what LPG is. George E. Marble, Michigan Consolidated Gas Co., talked on the subject of gas incinerators as load builders. Slides were shown of existing installations in the Detroit area.

Wednesday morning a skit directed by Miss Mildred Endner, home service director of the Minneapolis Gas Co., was presented under the title "A Three-Way Profit Program." W. F. Rockwell Jr., president of the Rockwell Manufacturing Co., gave the final talk of the three-day meeting and discussed the general future of the gas industry.

UNMATCHED ACCURACY

in direct flow indication

Wherever you seek simplicity and high accuracy in flow measurement at lowest cost, the Meriam "H" Meter is the well-known answer.



Here is an easy-to-install flowmeter . . . free of all conventional service requirements . . . giving long-term economy as well as low initial cost. There are no pressure tight bearings . . . no magnetic followers . . . no stuffing boxes . . . no hysteresis problems whatsoever. No calibration is ever required, yet you have the highest accuracy available.

★ *High operating pressures*
★ *High pressure differentials*
★ *All steel construction*
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LADDER type permits efficient operation in the closest quarters and under difficult conditions.

CUTS up to 5 ft. in depth in 8" to 12" widths; 4 ft. in 14" and 16" widths; straight and clean.

THE NEW BUCKEYE 403

For Fast, Low Cost Utility Ditching

The 403 is a small, easy-to-maneuver machine for digging water, gas, sewer, building foundations . . . Low bearing electric or telephone lines and for pressure to avoid damage to lawns or walkways . . . Easily transported from job to job and will travel over almost any type ground. Digs a clean, straight-sided trench with squared corners. Complete details from your distributor.

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Home service awards to be presented in October

Home service directors and individual members of home service departments of gas utility companies that are members of the AGA are eligible for the 1955 AGA home service achievement award sponsored by *McCall's Magazine.*

The awards, which will be presented at the AGA convention in Los Angeles in October, will be made to the department for achievement in its service area and to individuals for their ideas that have made the greatest contribution to the advancement of modern home-making by promoting interest in, and better use of, gas and modern gas equipment in the home.

The jury of awards will consist of the chairman and vice chairman of the AGA residential gas section and the present chairman and two past chairmen of the home service committee.

Corrosion short course attracts 228 attendants

Largest registration in its history was reported for the recent sixth annual short course on practical control of pipeline corrosion, sponsored by the Tulsa section of the NACE. There were 228 registrants from 20 states.

In addition to a demonstration of how to prevent corrosion, attendants attended a lecture section, which closed with a roundtable discussion and question-and-answer period.

The 1956 short course conducted by the Tulsa section will be held from Feb. 16-18 at the Mayo hotel in Tulsa.

Pennsylvania gasmen hold annual meeting

At its recent annual meeting, the Pennsylvania Natural Gas Men's Association elected F. N. Wolf, engineering vice president of Equitable Gas Co., Pittsburgh, to the presidency.

Other officers include Fred W. Batten, vice president of Manufacturers Light & Heat Co., Pittsburgh, vice president; and P. L. Kesel, Carnegie Natural Gas Co., also of Pittsburgh, secretary-treasurer. George Doying is manager of the association.

Directors of the association, in addition to the president and vice president, include A. W. Conover, Equitable Gas; J. C. Peterson, Manufacturers Light; H. D. Borger, Peoples Natural Gas Co.; R. L. Ehrman, T. W. Phillips Gas & Oil Co.; H. H. Pigott, Carnegie

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Natural; J. G. Montgomery, United Natural Gas Co.; H. D. Freeland; and Christy Payne Jr., Peoples Natural.

Corrosion conference attracts more than 1000

More than a thousand people dedicated to the art of corrosion prevention participated in one of the best of the annual meetings of the National Association of Corrosion Engineers, held during the week of March 7-11, at the Palmer House in Chicago. Featured during the convention were symposia dealing with corrosion causes and prevention, and clinics at which those with specific operational problems could call on the experience of those gathered for their solution. The work done by members from the gas industry was particularly outstanding.

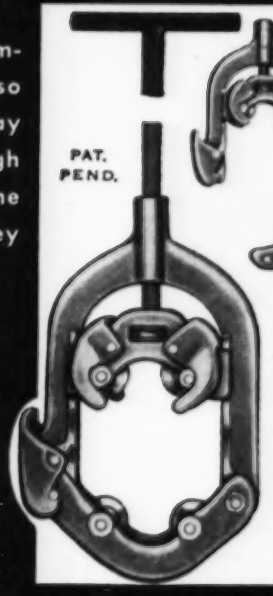
Discussions of immediate interest to the gas industry were a pipeline problem clinic, conducted by Chairman R. L. Bullock, Interstate Oil Pipe Line Co., and Vice Chairman Lyle R. Sheppard, Shell Pipe Line Corp.; and a cathodic protection clinic with Charles L. Woody, United Gas Corp., as the discussion leader. These groups were well attended and the interest in them ran unusually high. In addition, a protective coatings clinic-pipelines, under the leadership of L. A. Hugo, Phillips Petroleum Co., attracted a great interest among the gas industry delegation. The week was rounded out with meetings of the numerous committees, sessions dealing with corrosion control in all major industries, and reports and technical papers on non-gas industry projects.

New officers were installed during the annual banquet. They are Frank L. Whitney Jr., Monsanto Chemical Co., president; W. F. Fair Jr., Tar Products division of Koppers Co. Inc., vice president; Russell A. Brannon, Humble Pipe Line Co., Houston, treasurer.

One of the really busy places was the Hall of Exhibits, where many of the producers of products and services to the corrosion prevention field displayed their products and met with corrosion engineers for timely conversations. The exhibit rooms were full-to-over-flowing during the periods when formal meetings were not in progress. Students and technicians from the Chicago area were permitted to visit the exhibits to note the progress being made in the materials and techniques for corrosion mitigation.

IF YOU CUT LARGE DIAMETER PIPE . . .
YOU NEED THESE
New REED HINGED 4-WHEEL PIPE CUTTERS
Four sizes cover the range from 2½" to 12"

Users tell us these completely new cutters are so efficient they often "pay for themselves" through the savings in crew time on a half-dozen cuts. They are the first really practical tools for cutting off steel or cast iron pipe in sizes from 2½" to 12". You can, for example, cut 8" steel pipe completely off in less than five minutes.



Four wheel design requires minimum swing of handle—less digging in ditch work, easier "tight-corner" cuts.

Closed frame permits light weight with complete rigidity for better cutting.

4-point guide aligns the cutter on the pipe . . . assures perfect tracking and a right angle cut.

Reed Razor Blade wheels track perfectly, cut easily and roll down burr on steel pipe.

Unconditionally guaranteed to be the most efficient cutter you have ever used. Ask your jobber or write for literature.

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Telsco® the tight-sealing
PRESSURE FITTING
that conducts electricity

Telsco Long and Short Couplings, Adapters, 90° Elbows, and Tees, ½ through 2 inches.

Use Telsco Fittings on Plastic Pipe, too—Metal Stiffeners for this application are available.

The unique sealing principle used in Telsco Threadless Fittings concentrates great pressure, under containment, on *all sides* of a *small* rubber gasket (See cross section). Under this tremendous pressure, confined in a small area, the gasket forms a tight seal against leaks.

At the factory every Telsco Fitting gets a 90-pound air pressure test, under water—assuring a sound casting every time.

Telsco Fittings do not insulate. Instead they conduct static electricity without the time, effort and cost of bonding every connection.

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from *Runaway Pressures! Fires!*

NORWALK POSITIVE PRESSURE CUT OFF VALVES

- Gives automatic shut off when excessive pressure arises or fire occurs!
- Easily reset to desired cut off pressure!
- No pressure loss!
- All parts external to gas flow!
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A LIQUEFIED PETROLEUM GAS OF HIGHEST QUALITY

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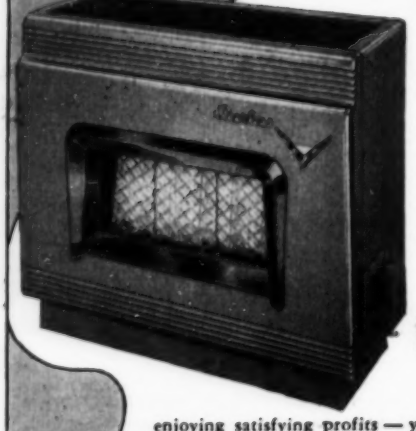
IF NOT, YOU NEED . . . .

Peerless GAS CONSOLE HEATERS
WITH THE LOW BOY LOOK

These *new* Heaters are *new* inside and out . . . with stimulating styling that sells . . . plus more engineering achievements that surpass all others.

Truly a triumph in beauty . . . styling . . . finish . . . performance . . . economy and engineered perfection . . . A trifle more in cost but twice the value . . . yet priced for the mass market.

There's no better proof of Peerless superiority than the countless thousands of satisfied users and the thousands of dealers



enjoying satisfying profits — year in and year out — and protecting their reputation as well.

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Officers elected by heating engineers

The American Society of Heating and Air-Conditioning Engineers elected John E. Haines vice president of Minneapolis-Honeywell Regulator Co., president at the 61st annual meeting held in Philadelphia, Jan. 24-27.

Other officers elected at the meeting are: first vice president, John W. James, of McDonnell & Miller; second vice president, Peter B. Gordon, Wolff & Munier Inc.; and treasurer, Elmer R. Queer, Pennsylvania State University.

Elected to serve on the society's council for a three-year term are: Bert W. Farnes, Bert Farnes Co.; Cary B. Gamble, Cary B. Gamble & Associates; Walter A. Grant, Carrier Corp.; D. M. Mills, F. J. Evans Engineering Co. Serving for a one-year term on council is Raymond T. Kern, Jennison Co.

GAS association notes

Five leaders of the oil industry in the South and Southwest were honored with American Petroleum Institute "Citations for Service" at the 1955 spring meeting of the Southwestern district of the API production division in New Orleans last month. They are Paul L. DeVerter, Humble Oil and Refining Co., Baytown, Texas; Hu M. Harris, Humble (retired), Houston; S. C. Oliphant, Tennessee Production Co., Houston; Drew Young, Atlantic Refining Co., Dallas; and Floyd E. Hatfield, Gulf Oil Corp., Fort Worth.

Two companies have been elected members of the industrial gas equipment division of GAMA. They are Field Control division of H. D. Conkey and Co., Mendota, Ill., makers of gas equipment for large scale industrial and commercial application, and Charles A. Hones Co., Baldwin, Long Island, manufacturers of industrial furnaces and combustion equipment.

The 29th annual meeting of the Natural Gas & Petroleum Association of Canada will be held on June 9-10. Headquarters will be the Royal Connaught hotel in Hamilton, Ontario.

The 10th annual exhibit and technical and management conference of the reinforced plastics division of the Society of the Plastic Industry was held in Los Angeles last month. More than 1000 persons from all parts of the U.S., Canada, and many other countries attended the three-day meeting at the Hotel Statler.

GAS people

Promotions

A. B. CATES JR. has been elected controller of Southern California Gas Co., Los Angeles, succeeding ERNEST N. SIMMONS, who has retired.

C. WILLIAM BAILEY has been promoted to manager of Consolidated Engineering Corp.'s analytical service laboratory and ROBERT C. HOFFMAN is supervisor of application engineering.

LEWIS W. BENTLEY has been named manager of the Detroit office of Industrial Crane & Hoist Corp., Chicago.

PAUL W. BRIGGS has been named assistant superintendent of the general accounting department of the Rochester (N. Y.) Gas & Electric Corp., and PHILIP H. GROPP is supervisor of the corporate division of the department. The changes were made to fill the vacancy caused by the death of HAROLD SCHECK.

CHARLES A. HEATH has been promoted to vice president and manager of Heath Tree Service Inc. He will continue to headquarter in Richmond, Mich.

C. M. JEWELL has been named sales manager of the newly organized sales division for Detroit-Michigan Stove Co.'s Garland line of commercial ranges. JOHN P. BEALS is assistant sales manager.

ALEX T. JOHNSON JR., sales manager in United Gas Co.'s Mississippi distribution division for seven years, has been named Louisiana-Mississippi sales manager in Shreveport. E. I. ROWE, who was utilization engineer in the Mississippi division, has become director of utilization for the two-state area, and Miss EMAGENE BURGE is home service director for the area.

WILLIAM R. COE has been elected a director of the Long Island Lighting Co., Mineola, N. Y., succeeding HARRY C. HAGERTY, who resigned.

Several promotions have been announced by Oklahoma Natural Gas Co. W. LEON BEASLEY is now manager of the newly organized Sapulpa area; JAMES W. WILLIAMS succeeds him as assistant to the Oklahoma City district superintendent; O. M. HEARTSILL JR. is commercial sales engineer in Tulsa; and LOREN T. MOORE succeeds him as manager at Bristow.

JOHN M. STORM has been promoted to sales manager for the domestic sales division of the Detroit-Michigan Stove Co.

In a reorganization of its traffic department, Gar Wood Industries Inc. has appointed GEORGE TRIVAN to the newly created post of general traffic manager. In addition, WALTER J. DERKATZ has been named traffic manager for the company's Wayne, Mich., plant.

WILLIAM COX and HARLAND MANTHEY have been appointed to the field sales force of the home appliance division of Hamilton Manufacturing Co., Two Rivers, Wis. Mr. Cox will cover central and southern California and the state of Arizona. Mr. Manthey will work in Oklahoma and Texas.

J. R. SNIDER, president of Tucson (Ariz.) Gas, Electric Light & Power Co., has been elected chairman of the board. He will continue as president.

RICHARD L. GOUCHOE has been named superintendent of a newly organized department for Central Vermont Public Service Corp., Rutland.

EDWARD B. PATTERSON has been named manager of the natural gas bureau, a sales promotion activity of both Southern Counties and Southern California Gas Co.'s, Los Angeles.

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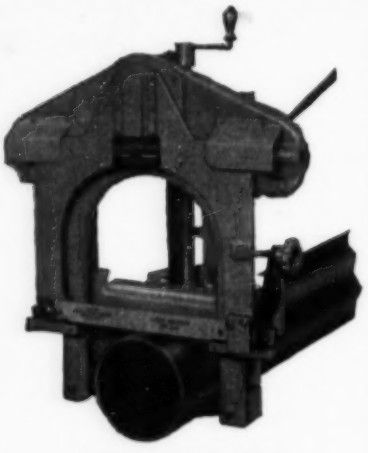

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people • *Continued*

DON O. MEEKER has joined Orbit Valve Co., Tulsa. He will headquarter in Odessa, Texas.

REMINGTON MERRY has been named division manager of the Berkshire Gas Co., Pittsfield, Mass., succeeding KENNETH E. HEATH, who resigned.

Ebasco Services Inc., New York, has appointed W. C. STRATTON as assistant to the engineering manager; E. L. SEELAND, superintendent of design; and E. N. PETERSON, project manager for Overseas Consultants Inc.

JACK C. VAN PADDENBURG and ROBERT SANEKOFF have been transferred to the eastern regional headquarters of ElectroData Corp. in New York.

STEPHEN D. MOXLEY, former executive vice president, has been named president of the American Cast Iron Pipe Co., Birmingham, succeeding CHARLES OTTO HODGES, who has retired. Other promotions include FRANK H. COUPLAND, vice president and works manager; ARNOLD J. HERRMANN, vice president and sales manager; KENNETH R. DANIEL, vice president and chief engineer; and A. E. BOWEN, treasurer.

S. D. Moxley
American Cast Iron

E. E. Fox
Honeywell

ELDON E. FOX, advertising manager, has been promoted to the newly created position of director of advertising and promotion for Minneapolis-Honeywell Regulator Co.

STUART H. NICHOLS, executive vice president, has been elected president of the Iroquois Gas Corp. and Republic Light, Heat & Power Co., succeeding OLIN F. FLUMERFELT, who retired. Iroquois Vice President ROGER B. COBB was elected vice president of Republic, succeeding Mr. Nichols.

Public Service Electric & Gas Corp., Newark, N. J., has announced the following changes: JOHN W. WILSON from superintendent of distribution, Patterson district, to conversion engi-

neer, general office; RONALD M. WHITE from assistant superintendent at Passaic to superintendent at Patterson; MARK G. HOEPFNER to assistant superintendent at Passaic.

GEORGE W. COUTLER has been named assistant business promotion manager for the Pittsburgh Group of Columbia Gas System.

L. M. AYERS, industrial relations manager for Consolidated Natural Gas Co., Pittsburgh, has retired.

JOHN S. MCELWAIN, formerly sales manager and personnel director of New York State Natural Gas Corp., has been appointed sales manager of the East Ohio Gas Cas Co., Cleveland.

E. H. BIRD has been elected president of Eastern Gas & Fuel Associates, succeeding HALFDAN LEE, who was elected chairman of the board of trustees.

EUGENE R. SEIFERT has been named sales manager of the New York State Natural Gas Corp., Pittsburgh. He will continue to supervise tax negotiations and will also handle special negotiations involving the purchase of new properties.

R. E. Risley **F. T. Newell**
Dresser Manufacturing

Dresser Manufacturing Div., Bradford, Pa., has promoted ROGER E. RISLEY to director of engineering and FRED T. NEWELL to chief product engineer.

North Penn Gas Co., Port Allegany, Pa., has elected JACK GADDESS president succeeding the late J. H. ISHERWOOD. Others named to new posts: FRANKLIN B. GILMORE, executive vice president and secretary; GEORGE E. NADOLSKE, vice president and controller; and J. ROBERT BUFORD, treasurer.

HUNTLY BRIGGS has rejoined General Controls Co., Glendale, Calif., as assistant advertising and sales promotion manager.

W. K. WALTERS has been put in Charge of General Controls' Houston branch office.

DR. E. W. VOLKMANN has been appointed manager, research department of Koppers Co. Inc., Pittsburgh. DR. A. R. POWELL, who has been acting manager, is now special research adviser.

At Lone Star Gas Co., Dallas, THOMAS S. BACON has been named director of the newly created research and development department and B. R. HATLEY takes over the newly created post of assistant general sales and promotion manager.

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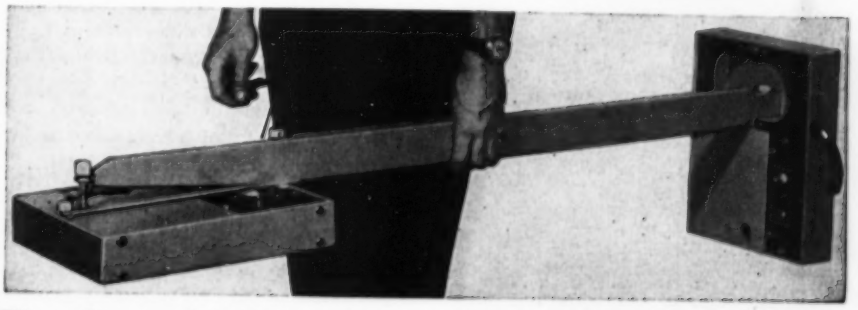

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Recent promotions at North Shore Gas Co., Waukegan, Ill., include VERNE L. GERRY, superintendent of distribution and OSCAR F. ROGERS, superintendent of production and engineering.

ACF Industries Inc., New York, has named RICHARD E. KIEL as national sales manager and GREGORY S. ASBEE as eastern district sales manager.

The following promotions have been announced by Laclede Gas Co., St. Louis: LEE LIBERMAN, assistant superintendent of distribution in charge of construction and maintenance; R. F. HEBELER, assistant superintendent of distribution in charge of service and measurement division; P. J. GRATIAA, superintendent of measurement and service standards; V. L. RASMUSSEN, superintendent in charge of cathodic protection; OTTO FINK, assistant superintendent of street division; W. C. MAAG, assistant superintendent of the city street division; J. C. VOGT, and D. E. MUELLER assistants to the superintendent of distribution.

D. A. HULCY, president of Lone Star Gas Co., has been elected president of the Dallas Citizens Council, a group of Dallas business executive and civic leaders.

C. E. LONGENECKER JR. has been named divisional sales representative of the Caloric Appliance Corp. for the greater Detroit area.

C. E. Longenecker
Caloric

W. D. Willes
Rockwell

W. D. WILLES, former general manager of Rockwell Manufacturing Co.'s Nordstrom valve plants at Barberton, Ohio, and Oakland, Calif., has been named product manager, Nordstrom valves, with headquarters at Pittsburgh.

WESLEY A. COOK has been elected vice president of Portland (Ore.) Gas & Coke Co.

Deaths

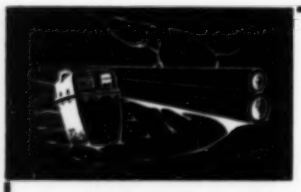
CHARLES F. DE MEY, 58, vice president and chief engineer of the Columbia Gas System Service Corp. died in Stamford, Conn. on Feb. 27 after a short illness.

W. F. MUNNIKHUYSEN, formerly executive vice president, was elected chairman of Koppers Co. Inc., Pittsburgh, at a special board meeting recently. FRED C. FOY, who has been vice president and general manager of the company's tar products division since 1950, was elected president and chief executive officer.

JAMES L. RICHARDS, chairman of the board of Boston (Mass.) Consolidated Gas Co., died recently. He was instrumental in the formation of Boston Consolidated 50 years ago and was its first president.

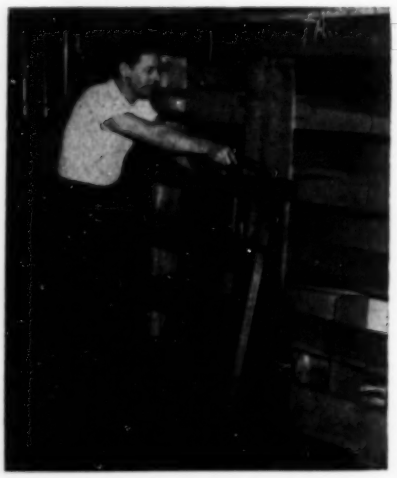
WILLIAM SCHMIDT JR., chairman of the board and former president of the Consolidated Gas, Electric Light & Power Co. of Baltimore, died in February. Mr. Schmidt, 72, had been with the company and its predecessor for 56 years.

FRED R. SWANSON, 71, manager of Philadelphia Electric Co.'s Schuylkill division, died in February following a long illness.

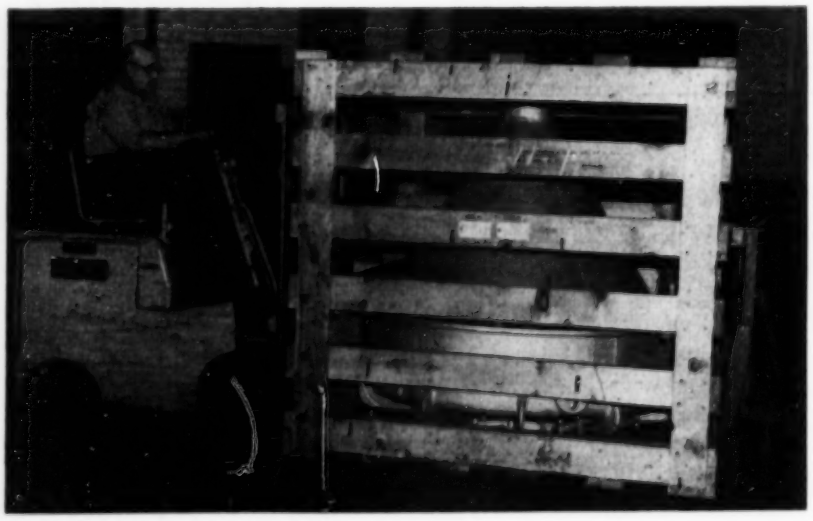


SHORT CUTS IN MATERIALS HANDLING: **9**

Hydraulic jack and lifter



To afford horizontal transportation of large crates (up to 5 tons) manually (left) or with the aid of fork trucks (bottom photo) Consolidated Edison Co. of New York uses this combination of a hydraulic jack and rollers. Rol-A-Lift, made by Skarnes Eng. & Supply Co., Minneapolis, is designed to handle extremely bulky items in and out of tight spots where overhead cranes cannot operate. The manually operated hydraulic lift has a 6-in. lifting height, is 45 in. high, 25 in. wide; the adjustable forks weigh 420 lb per pair. It is made of steel frame electrically welded.



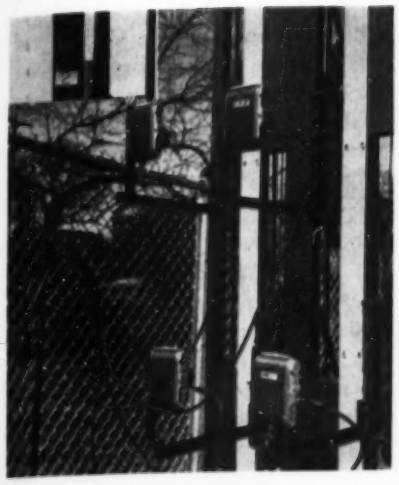
AGA materials handling subcommittee.

GAS

APRIL 1955

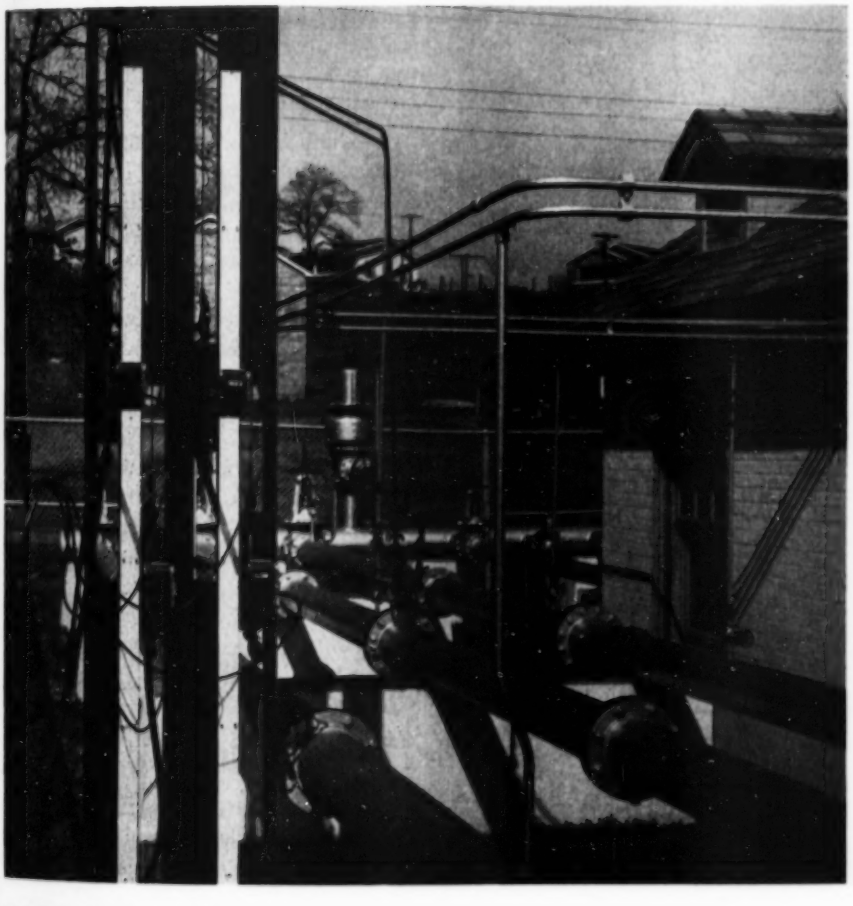
Gas measurement with a gate valve

GAS exclusive



By C. E. TERRELL
Superintendent of measurement
Southern Natural Gas Co.,
Birmingham

Fig. 1 (bottom) and 1a (left). Southern Natural's present test equipment with high pressure 100-in. manometers and cameras.



THE need for reliable flow rate information in the operation of pipeline systems is rarely, if ever, completely satisfied. There are unmetered points on large transmission lines where the volume rate would be useful to the dispatchers when operating at peak capacity; to the design engineers planning the looping or extension of existing lines; to the pipeline superintendent for judging the efficiency of sections of line in scheduling cleaning jobs to maintain deliverability; to the superintendent of compressor stations for a check on compressor capacities. And to the measurement staff, reliable metering at many points on the system is of value in locating unfavorable conditions in respect to unaccounted-for gas.

While the facilities to measure pipeline flows at multiple points on the system are highly useful, the installation of customary orifice metering equipment is one of considerable cost. Unlike the meter station for a city gate or an industrial customer, the pipeline check meter station measures no direct revenue and, therefore, its economic value is more difficult to support.

It was in the interest of this problem that the idea occurred to investigate the possibilities of using pipeline valves for a primary metering device. As block valves are generally placed in cross-country pipelines at intervals of from five to 15 miles to make it possible to service line breaks and other repairs without interruption of service, some of these valves, if designed for accuracy as a head meter, would provide almost unlimited locations for metering at relatively small cost.

Since large volume measurement for commercial purposes on natural gas pipelines is made with the use of the square-edged orifice, any check-metering equipment on pipeline locations

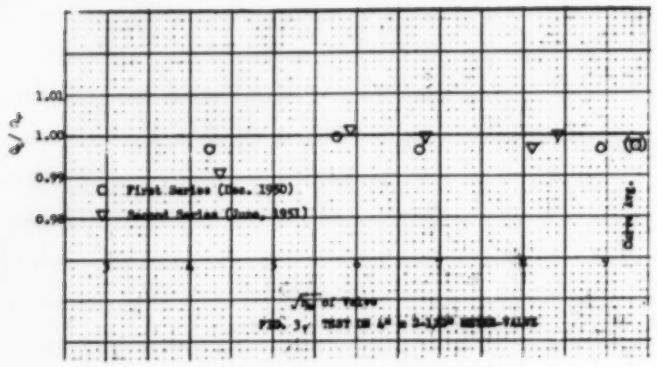


Fig. 3. Comparison of Q_t and Q_r, 4-in. meter valve.

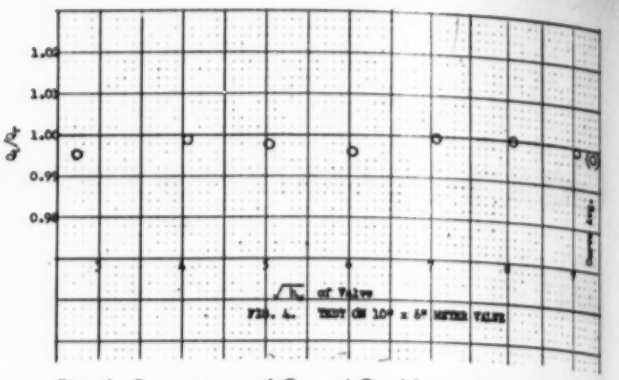


Fig. 4. Comparison of Q_t and Q_r, 10-in. meter valve.

should have accuracy close to that of the orifice meter. Therefore, the design of a primary element in the body of a valve must have these qualifications:

(1) Reproducibility in manufacture substantially equal to that of the square-edged orifice and with a coefficient of discharge so that individual calibration of the unit will be unnecessary.

(2) A Beta ratio practical for normal pipeline flows with maximum differential recovery in respect to overall pressure loss.

(3) Leading edges not subject to erosion from the gas flow for a permanent coefficient value.

(4) Practical dimensions. i.e., overall length close to that of the standard valve.

In the study of these possibilities, a small cutaway model of a "venturi" type W-K-M valve was borrowed from Thomas S. Blanton of W-K-M Manufacturing Co. As a result of this study, three 4-in. Series 300 valves were designed with 2-in., 2.5-in., and 3-in. throats. The valves were then manufactured to our specifications by W-K-M. We were prepared to test the flow coefficient of these valves against orifice meter references at Southern Natural's North Birmingham measuring station.

Valve body design

The shape of the primary element in the body of the meter-valve employs a 21° included angle in the convergent cone as is used in the inlet cone of the venturi meter; however, in all other respects it differs from the venturi as follows: (a) In the valve's primary device, the intersection of the inlet and outlet cones with the throat is of angular design instead of the easy tangential curves used in the transitions to and from the throat in the venturi; (b) the valve throat is a cylinder, the design length of which is a ratio of the throat diameter; and (c), the divergent cone of the valve is a duplicate of the convergent cone, providing for the measurement, if required, of reverse flow.

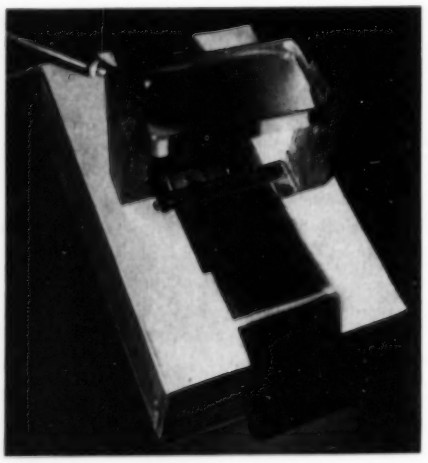


Fig. 2. Illuminated cabinet for magnified reading of test films.

In our earlier considerations for making a shutoff valve serve for flow measurement, it was thought that a specially designed cone inserted on the inlet side of a full size common gate valve or a machined inlet taper in the body might be used on an ordinary wedge seat gate valve. Subsequent testing, however, on the differential gradient through the throat of the present design as well as on different primary shapes, cast and machined for testing, removed such cones and tapers from consideration for precision measurement. In the use of this primary device, a cylindrical throat of proportional length has been found to be essential to flow metering accuracy.

In respect to pressure loss, tests show that the pressure recovery characteristic of the shape used with these meter-valves is approximately 85%. In other words, with 82-in., or approximately 3.0-lb, differential at the throat tap, the differential pressure will be approximately 12.5-in. or less than ½ lb across 2½ and 8 diameter connections *(Figs. 14 and 15)*.

All relationships, including the location of pressure taps, are dimensioned from the diameter, d_2, of the throat section.

TABLE 1. NORTH BIRMINGHAM MEASURING STATION
(4.031 in. x 2.499 in. Series 300 meter-valve vs 8.071 in. x 3.500 in. carbon steel orifice plate No. 2219)

Meter-Valve Differential @ ± 62 Psig	(Flange Taps) Meter-Valve Cfh (Q_t)	Reference Meter Cfh (Q_r)	Q_t/Q_r
First Series—December 1950:			
17.75 in.	110,150	110,506	.9968
33.22 in.	150,162	150,193	.9998
45.34 in.	174,283	174,926	.9963
79.83 in.	224,611	225,342	.9968
Average			.9974
Second Series—June 1951:			
19.15 in.	110,557	111,566	.9910
35.20 in.	148,786	148,587	1.0013
46.92 in.	170,678	170,746	.9996
65.97 in.	200,039	200,689	.9968
70.73 in.	206,434	206,459	.9999
Average			.9977

Test facilities

Southern Natural has favorable conditions at its North Birmingham measuring station and Bass Junction receiv-

ing station for making tests on flow metering equipment. The North Birmingham station operates as one of several city gates delivering to Alabama Gas Corp.'s Birmingham distribution system, where delivery pressures over the 8-in. runs seasonally vary from 60 to 125 psig. Its flow rates may be increased or reduced to meet test rates, as volumes into other stations serving the system can also be changed.

The Bass Junction receiving station is an intra-system metering point near Macon, Ga. Its two 12-in. runs measure the gas delivered by the 1200-lb South system pipeline into the 600-lb Macon lateral. Testing here is done with one of the 12-in. runs as reference in series with the test setup, the flow rates being diverted with the other 12-in. run.

These two stations provide, respectively, medium volumes and moderate pressure conditions at North Birmingham for the smaller test equipment, and at Bass Junction, up to 85 million a day at around 500 psig for larger flow rates. Originally, the North Birmingham station had 8-in. check meter runs, which now leave a space between headers to flange in equipment to be tested in series with a master 8-in. run as the reference. Test equipment at Bass Junction is installed on the downstream side,

Check measurement on lines from Gulf Coast fields

(Fig. 5 (below) shows location of meter valves on the south Louisiana supply system.)

1. Breton Island check station on the Olga platform (A, Fig. 5).

This 8-in. meter-valve is installed on the terminus of the 15-mile 12-in. offshore line from Breton Island field. Its record is compared with two 6-in. meter runs at Breton Island receiving station on the island.

2. Toca 20-in. check station (B, Fig. 5).

The meter record of this 14-in. valve, located on the suction side of Toca compressor station, is checked against the combined records of two 8-in. runs at Romere Pass receiving station; two 6-in. runs at Main Pass receiving station; two 4-in. runs at Coquille Bay receiving station; and the abovementioned Breton Island receiving station.

3. Barataria check station (C, Fig. 5).

This 8-in. meter-valve, also located on the suction side of Toca compressor station at the terminus of the 22-mile 12-in. Barataria lateral, checks the combined records of Barataria receiving station and Bayou de Fleur-Alliance receiving station.

4. East leg check station (D, Fig. 5).

The meter record of this 14-in. valve, located at the terminus of the 20-in. lateral extending southward from Franklinton, La., to the gas fields of the Mississippi Delta, checks the total of the six receiving stations abovementioned plus that of the Big Point receiving station.

5. Lake Sand line check station (E, Fig. 5).

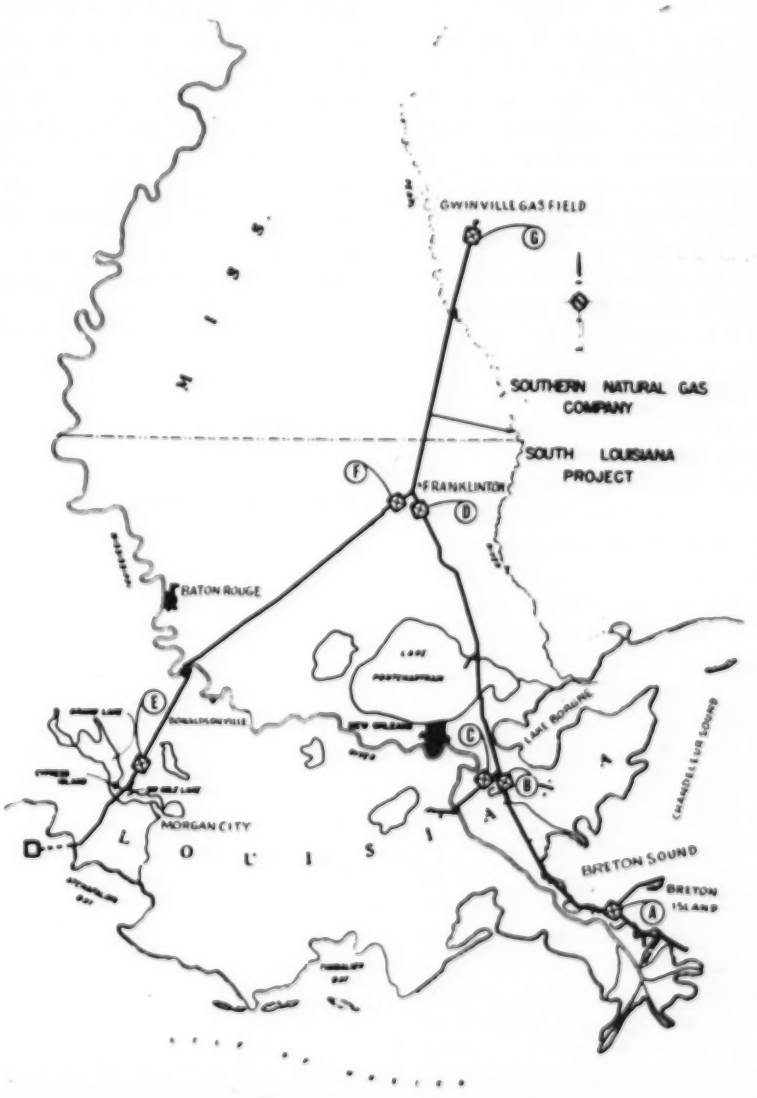
This 8-in. valve is located on the Duck Lake platform at the terminus of the 19-mile 12-in. line from the Lake Sand receiving station to the Duck Island field. Its meter record is checked against two 6-in. runs at the Lake Sand station.

6. West leg check station (F, Fig. 5).

This 14-in. valve, located at the terminus of the 20-in. lateral from southwest Louisiana to Franklinton, checks the meter records of the Lake Sand and Duck Lake receiving stations.

7. Franklinton line check station at Gwinville (G, Fig. 5).

At this point, two 14-in. meter-valves are located at the terminus of the 24-in. line on the south Louisiana system *(Fig. 6)*. These valves have calculated coefficients of 28878.15 each. They are on the suction of the Gwinville compressor station, the metering pressure being around 650 psig. While there are scrubbers between the meter-valves and the compressors, there is evidence of considerable pulsation on the meters; however, these two meter-valves have shown fairly accurate performance despite pulsation and some hydrate interference. For the month of October, the total of the volumes on the 10 receiving stations supplying the south Louisiana system pipelines was 3,878,028 Mcf. This gas was remeasured on the two 14-in. meter-valves at Franklinton line check station as 3,863,465 Mcf, a difference of .38 of 1%. The records of these two valves may indicate that the shape of this primary device is less subject to error from compressor pulsation than is the case with the square-edged orifice.



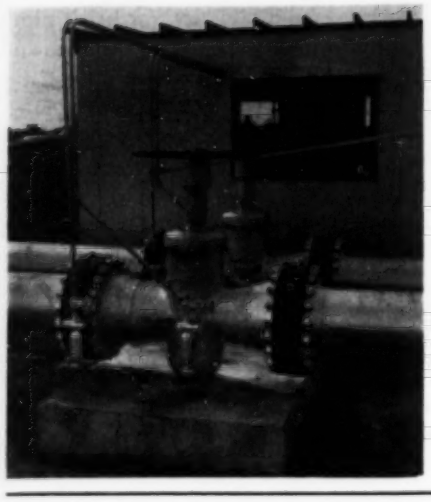


Fig. 6 (left). Franklinton line check station, terminus of the south Louisiana supply system, with two 14-in. meter valves.

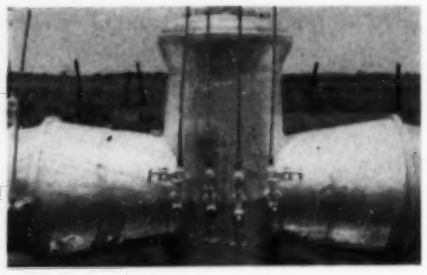


Fig. 7 (above). Close-up of 24-in. meter valve at Refugio test site, showing differential pressure taps.

at a 90° angle, from 12-in. Run No. 1, which serves as the reference meter.

The meter runs at each of these stations are extra long in tube sections as well as in length of straightening vanes. The length of the tubes meets our extrapolation of the curve sheet of Fig. 5 of AGA Report No. 2 to a theoretical Beta of 1.0. These meter runs in all respects are within AGA Report No. 2 specifications. All test work has been done with factory-bored orifice plates.

In the first tests on the 4-in. meter valves the readings on differential manometers, dead-weight pressure gauges and thermometers were made by the observation method of 10 readings at 30-second intervals for each flow rate, following the method used by AGA in the Rockville, Md., tests.* Our current practice is to take seven flow rates on each test, at approximate intervals of one on the square roots of the differential from 3 to 9, thus the seven flow rates range from ± 9-in. to ± 81-in. differential. During the past two years, all test work has been done with the use of photographed records of the differentials similar to that used by AGA in the large diameter tests at Refugio. These film records are superior to the observation method as they remove the possibility of personal error in reading the manometers, are subject to checking, and give a permanent filmed record of the test.

Fig. 1 and *1-A* shows Southern Natural's present test equipment with the high pressure 100-in. manometers and cameras. Penberthy gauges, counterweighted for adjustment to the required differential position, are connected to ½-in. hydraulic hose from the pressure tap connections. Ansco Speedex 4.5 cameras with portrait attachments are bracketed 12 in. in front of the 100-in. Meriam scales, which are mounted flush with the glass in the manometer gauges. Cameras are simultaneously snapped by the pneumatic system shown in the picture. Pressure readings on conventional dead-weight test gauges, as well as flowing temperature readings on certified indicating thermometers, are observed manually as each picture of the differential is snapped. Twelve pictures are filmed on each rate of flow, a total of 336 pictures on the film for each test. Two men read and tabulate the film record. Each frame of the film is magnified as it passes over a narrow opening in an illuminated compartment *(Fig. 2)* for accuracy in reading. We find that reading film on this device is as accurate as any projection enlargement we have used.

*See "Preliminary Test Results in AGA - ASME Rockville Orifice Research" by F. M. Partridge, *GAS*, April 1950, pp. 75-81.

The equation

The equation for computing the flow through the shape of the primary device used in the meter-valve is the familiar one for head meters set out in "Fluid Meters, Their Theory and Application," ASME Research Publication, 1937, Page 50, Eq. (101):

$$q_1 \text{ (cfs at } P_1, T_1) = 0.06068\ K Y_1 D_2^2 \sqrt{\frac{h'_w T_1}{P_1 G_r}}$$

From this formula, the hourly coefficient may be calculated, say for a standard condition of 0.60 specific gravity and flowing temperature of 60° F at 14.9 pressure base, by the equation, $\text{Coef.} = 431.653 \frac{D_2^2}{\sqrt{1 - B^4}}$. Thus for the following meter-valve sizes used in the test work and those now in service on Southern Natural's system, the hourly coefficients are:

*4.034 x 2.499	2919.27
6.068 x 3.770	6646.16
7.980 x 4.840	10873.99
10.017 x 6.076	17125.00

TABLE 2. BASS JUNCTION MEASURING STATION
(10.017. in x 6.076 in. Series 300 meter-valve vs 12.008 in. x 7.75 in. orifice plates)

Meter-Valve Differential @ ± 495 Psig	(Flange Taps) Meter-Valve Cfh (Q_t)	*12 in. x 7.75 in. Reference Meter—Cfh (Q_r)	Q_t/Q_r
First Series — January 1953:			
7.47 in.	1,072,872	1,077,629	.9956
16.14 in.	1,579,190	1,581,285	.9987
25.16 in.	1,968,299	1,972,443	.9979
36.15 in.	2,379,222	2,388,637	.9961
49.59 in.	2,747,356	2,748,103	.9997
64.63 in.	3,128,335	3,128,676	.9999
82.09 in.	3,518,706	3,522,083	.9990
Average			.9981
Meter Chart Record:	Meter-Valve Mcf (Q_t)	*12 in. x 7.75 in. Reference Meter—Mcf (Q_r)	Q_t/Q_r
March 1953	1,242,352	*1,245,176	.9977
April	1,022,754	*1,023,743	.9990
Total	2,265,106	2,268,919	.9983
August	2,219,735	**2,233,262	.9939
September	2,170,641	**2,183,059	.9943
October (1-25, incl.)	1,634,123	**1,637,765	.9978
Total	6,024,499	6,054,086	.9951

*Carbon Steel Orifice Plate No. 2636.
**Stainless Steel Orifice Plate No. 3472.

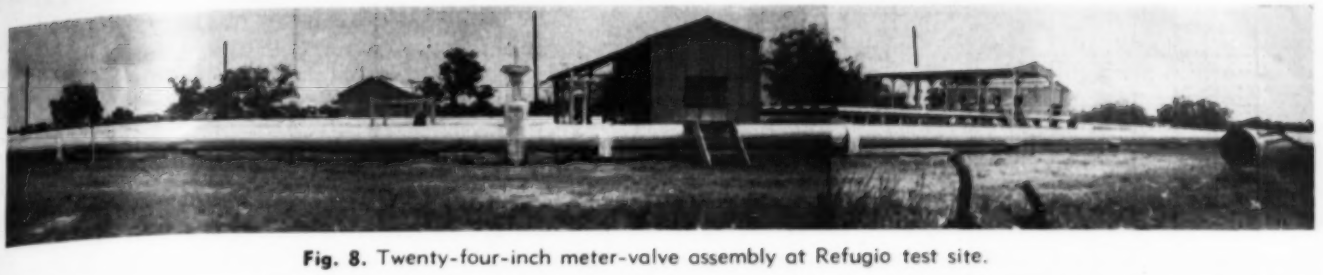


Fig. 8. Twenty-four-inch meter-valve assembly at Refugio test site.

11.750 x 7.178	23973.58
13.002 x 7.887	28878.15
23.014 x 14.159	93492.46

(*ID of 4-in. U. S. tube)

As an example of the capacity of a meter-valve, the 24-hour flow rate on the 24-in. valve at differential of 81 in. and 600 psig with flowing temperature of 60° F and specific gravity of .60 would be as shown in the equation below.

The Reynolds number factors applied to the meter-valve calculations were taken from the table and formulae for flange taps in AGA Report No. 2. These were used in the absence of Reynolds numbers especially developed for the meter-valve. Data from the tests are being studied toward setting up precise R_d factors for this primary shape.

The expansion factors, Y_1, were taken from the values of Ø in Table 2, page 48, ASME Research Report on Fluid Meters. While the static pressure, P_1, is normally taken from the upstream differential tap on the meter-valve, we have, on certain tests on the 4-in. by 2½-in. valve, observed simultaneous dead-weight pressure readings from the downstream or throat tap and, using factors from a curve plotted for Ø for Y_2, have calculated the volume against that computed with the Y_1 factor within 0.15 of 1%. These observations were made to verify the accuracy of Y_1 factors.

$$(24)\ 93492.46\ \sqrt{81\ (600 + 14.4)}\ \ \underbrace{(1.0001)}_{F_r}\ \ \underbrace{.9967}_{Y_1}\ \ \underbrace{(1.045)}_{F_{pv}} = 521.40\ M^2 \text{ per day.}$$

Tests

The first tests on the meter-valves were made at Southern Natural's North Birmingham station on these 4-in. Series 300 valves in December 1950. Three shapes were tested, a 4.031 in. by 2.002 in. with 26½° included angle on the convergent and divergent cones; a 4.031 in. by 2.499 in. with 21° cones; and a 4.031 in. by 3.00 in. with 21° cones. The reference meter was an 8-in. Series 300 meter run, upstream ID 8.071 in., downstream ID 8.074 in., with welding neck orifice flanges. New carbon steel orifice plates were used in the reference run. The size of these orifice plates were 2.750 in., 3.500 in., and 4.000 in., respectively. The meter-valves were flanged into 4-in. Series 300 meter tubes of 4.034 in. ID upstream

Test No 7 – 81 " Refugio Test Site
Date June 12 1954

10" Reference Meters
Flange Taps - Static Pressure From Downstream Taps
Volumes at 14.9 psia

Pressure 675.53 psia
Temperature 83 °F

	h_w	$\sqrt{h_w}$
Tube No. 1	84.03	9.1649
2	84.00	9.162
3	84.88	9.2191
4	84.48	9.1914
5	84.45	9.1897
6	83.92	9.1608
7	83.51	9.1384
8	83.76	9.1521
Total		73.2777
		÷8 = 9.1722
9.1722²		84.129

Tube I.D. 10.054" Orifice 6.40"
Temperature Factor, F_{tf} .9786
Coefficient 3 · 93,333 68
Computation For Reynolds No. Factor
$F_r = 1 + (N_1 \div \sqrt{h_w p_f})$
$N_1 = .045$
$F_r = 1 + .045 \mid 238.40 = 1.0002$
Computation For Expansion Factor
$Y_2 = 1 + N_2 (h_w \mid p_f)$
$N_2 = .0051$
$Y_2 = 1 + .0051 (84.13 \mid 675.53)$
$Y_2 = 1 + .0051 (.12)$
$Y_2 = 1.0006$

$\sqrt{h_w p_f} = \sqrt{84.13} = 675.53 = \sqrt{56832.94} = 238.40$

Coefficient S : 93333.68 / 22.256.749
F_{tf} : .9786 / 21.774.533
F_r : 1.0002 / 21.778.821
Y_2 : 1.0006
¹CF Per Hour : 21,792.005

¹Does Not Include Gravity And Supercompressibility Factors Since Their Values Are The Same On Both Test And Reference Meters

Fig. 9. Reference meter calculation sheet, Test No. 7 on 24-in. meter-valve at Refugio.

Test No 7 – 81 " Refugio Test Site
U.S. Tap No A Date June 12 1954
D.S. Tap No 2

Test - 24" Meter Valve
Pressure From Upstream Side
Volume at 14.9 psia

Pressure 677.08 psia
h_w 84.11
Temperature 83 °F
Computation for Expansion Factor Y_1
h_w / p_f = 84.11 / 677.08 = .12

h_w / p_f	Y_1
01	9998
02	9995
03	9994
04	9989
05	9987
06	9984
07	9981
08	9979
09	9976
10	9973
11	9971
12	9969
13	9967
14	9964
15	9962
16	9959

Meter Valve I.D. 24.014 = 14.199
Coefficient 93492.46
Temperature Factor F_{tf} .9786
Computation for Reynolds Number Factor
$F_r = 1 + .02032 / \sqrt{h_w p_f}$
$F_r = 1 + .02032 / 238.64$
$F_r = 1.0001$

$\sqrt{h_w p_f} = \sqrt{84.11} = 9.1708 \times 26.00 = 238.64$

Coefficient 93492.46 / 22.311.041
F_{tf} .9786 / 21.833.485
F_r 1.0001 / 21.835.768
Y_1 .9969
¹CF Per Hour 21.768.077

¹CF Per Hour (Test) 21.768.077 / ¹CF Per Hour (Ref.) 21.792.005 = .9989 % Correct

¹Does Not Include Gravity And Supercompressibility Factors Since Their Values Are The Same On Both Test And Reference Meters

Fig. 10. Test meter calculation sheet, Test No. 7 on 24-in. meter valve at Refugio.

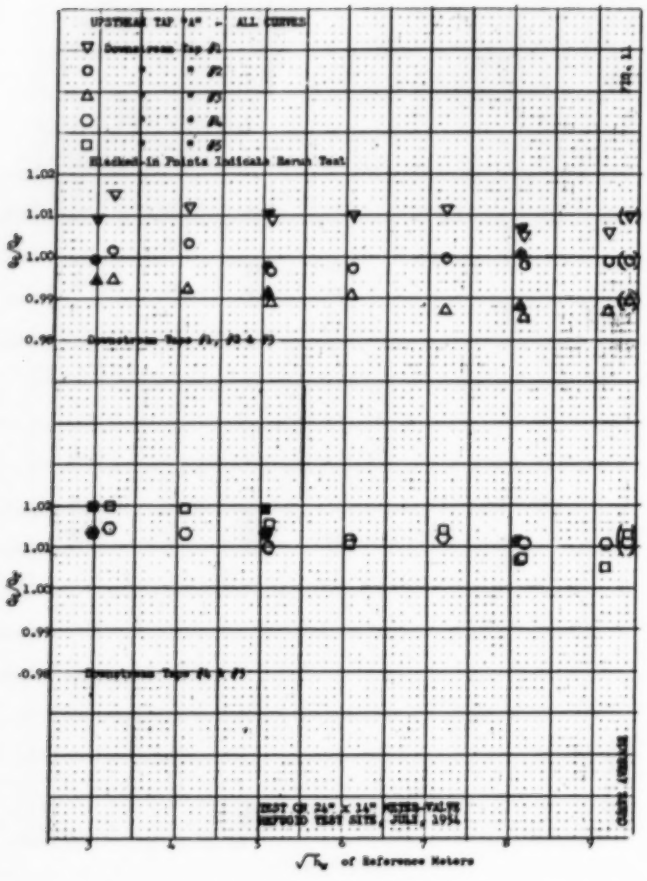


Fig. 11. Comparison of Q_t and Q_r, using upstream pressure tap "A", 24-in. meter valve test at Refugio.

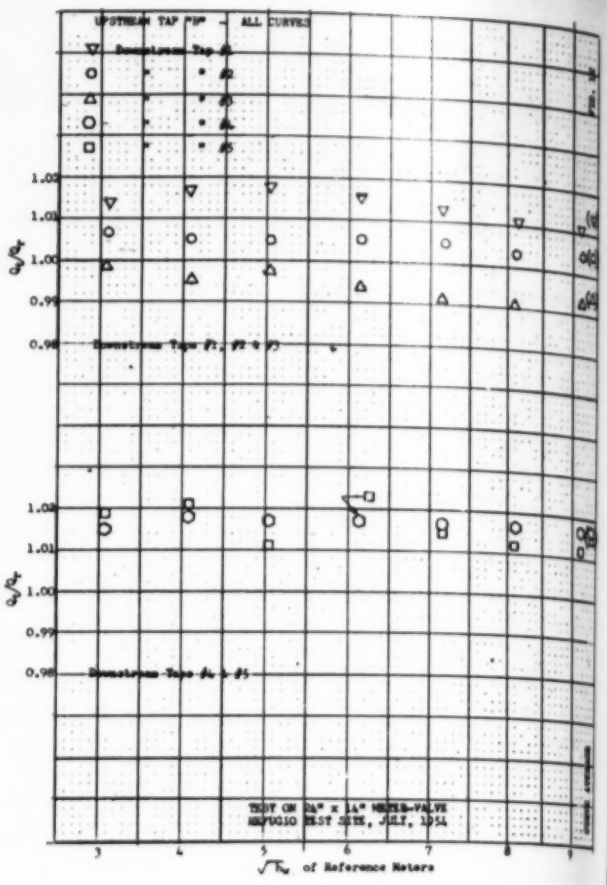


Fig. 12. Comparison of Q_t and Q_r, using upstream pressure tap "B", 24-in. meter valve test at Refugio.

and 4.029 in. ID downstream with out-of-roundness percentages of 0.20% and 0.15%, respectively.

These tests indicated that the 4- by 2½-in. meter-valve only gave a flat curve in the coefficient of discharge This 4-in. meter-valve checked closely with the reference meter at valve differentials of 17.75 in., 33.22 in., 45.34 in., and 79.83 in. A check test on the valve in June 1951 followed close to the December 1950 test. *Table 1* and *Fig. 3* show the results of these tests.

These early tests were made with single-column water manometers on differentials below 20 in., with 50-in. U-gauge water manometers between 20 in. and 50 in. and with 20-in. single column manometers using mercury above differential of 50-in. h_w. The present 100-in. water manometer equipment *(Fig. 1)* was built in January 1953.

With the encouraging results of the test on the 4-in. valve, the next step was to make a larger one, expanding the shape in approximate geometric proportions, to test the possibilities of reproducibility and consistency of the coefficient as the unit was enlarged. We designed a 10-in. Series 300 valve with internal diameters of 10.017 in. and 6.076 in. In this valve, the Beta ratio was reduced to .6066, changing the shape from the .6195 β of the 4-in. valve to provide data on the effect of change in the d/D ratio.

This valve, having a calculated coefficient of 17125.00 at 14.9 P.B., .60 gravity and 60° F, was flanged with meter tubes of 10.045-in. ID in the upstream section and 10.048-in. ID in the downstream section. These tubes had an out-of-roundness of 0.21% and 0.23%, respectively. The 10-in. meter-valve run was installed on the downstream side and in series with the 12-in. Series 300 meter run with 12.008 ID in the upstream tube and 11.995 in. in the downstream tube. These reference tubes had out-of-roundness of 0.22% and 0.35%, respectively.

The test on the 10-in. valve was made in January 1953 using the test equipment shown in *Fig. 1* with a photographed record of the reference and test differentials. A new 12-in. x 7.75-in. carbon steel orifice plate was used in the reference run. Its flange tap coefficient was 17188.30. This coefficient, being close to the valve's coefficient, gave almost the same differentials in the reference and the test runs. The tests were made at Bass Junction's delivery pressure of around 495 psig. *Table 2* and *Fig. 4* show the results of this test. The average of the seven rates of flow at 27 M^2 day to 84 M^2 day gave the meter-valve a coefficient of discharge of 1.0019. *Table 2* also shows results of a metered chart record for March and April 1953 of the 12-in. run with the 7.75-in. carbon steel plate used in the original test versus the 10-in. meter-valve; and a later chart record for August, September and 25 days in October, using a 7.75-in. srainless steel plate versus the valve.

Following our tests with these valves, it was felt that reliable data were at hand to design metering valves for further experimenting in pipeline operations. An opportunity to do this came with Southern Natural's 1953 expansion program for extending its supply lines to the Louisiana Gulf Coast and marketing pipelines into eastern Georgia and South Carolina.

A need for check measurement on the pipelines from the Gulf Coast fields provided seven points at which it was decided to use the meter-valve (as shown on the map, *Fig. 5*, and in the box on page 131).

The meter-valves on the south Louisiana system were designed for maximum capacities of the pipelines but, in the first year's operation, minimum takes have in some periods given extremely low differentials, 1 in. to 2 in., for which they were not designed; however, where reasonable metering conditions prevailed, they have done very well. For instance, at the Lake Sand check station an 8-in. meter-valve, recorded in October, 1,566,407 Mcf against Lake Sand receiving station's orifice metering of 1,563,764 Mcf, a difference of .17 of 1%. Since it was placed in operation in December 1953, this valve has recorded, in the 11 months ending October 1954, 12,441,847 Mcf compared with the Lake Sand receiving station volume of 12,353,612 Mcf, a difference of .71 of 1%. The East Leg check station has recorded from February 1954 to October 1954, inclusive, 12,941,466 Mcf against the seven receiving stations supplying this 20-in. lateral with a total of 12,982,043 Mcf, a difference of .31 of 1%.

In addition to the seven check meter stations above mentioned on the South Louisiana supply system, where the meter-valves are used as the primary device, Southern has two 14-in. and one 10-in. on the terminus of the 750-lb 24-in. loop line of the north system, about 50 miles east of Birmingham; one 14-in. at Bass Junction near Macon, Ga., at the inlet to the new 16-in. pipeline extending to Aiken, S. C., and a 12-in. located about seven miles north of Savannah on the 14-in. line serving that area. The company now has in service eight 14-in., one 12-in., one 10-in. and three 8-in. meter-valves. None of these are operating as pipeline block valves, but in some instances serve as shutoff valves for pressure regulator installations. The valves have mainly been installed for their value in high recovery of measurement pressure loss and in the economy of measuring station installation. The Franklinton line check station at Gwinville *(Fig. 6)*, having a daily capacity of 346 MMcf at 85 in. h_w and 650 psig, cost less than one-third of the original estimate and budget figure for multiple meter-run measurement at this point.

In the foregoing, we have discussed generally some of our work in developing the meter-valve and its subsequent experimental use on the pipelines. Following the testing of the 4-in. and 10-in. sizes and expanding the size to 14 in. for some of the pipeline locations and

TABLE 3. REFUGIO TEST SITE—JULY 1954
(Summary of Test Results on 24" x 14" Meter-Valve)

Date	Upstream Pressure Taps "A" & "B"	Test No.	Average of Reference Manometer h_w	Q_c/Q_r					Meter Valve Pressure Loss (2½ & 8 Connections)		Specific Gravity	M^2 24 Hour Rate**	Psia Reference Meters	Psia Test Meters
				No. 1	Valve No. 2	Throat Pressure No. 3	Tap: No. 4	No. 5	Manometer h_w	Psig*				
7-12-54	Series A	1	9.22"	1.0153	1.0019	.9943	1.0143	1.0197	1.40"	0.05	—	176	659.68	660.04
	A	2	16.78"	1.0122	1.0033	.9923	1.0128	1.0187	2.55"	0.09	—	238	658.66	659.04
	A	3	25.94"	1.0095	.9962	.9894	1.0099	1.0150	3.83"	0.13	—	296	660.98	661.39
	A	4	36.92"	1.0101	.9972	.9909	1.0117	1.0104	5.81"	0.20	.597	356	670.57	670.99
	A	5	51.80"	1.0118	.9997	.9871	1.0122	1.0138	8.19"	0.28	—	421	673.32	673.76
	A	6	66.36"	1.0055	.9981	.9859	1.0112	1.0069	10.32"	0.36	—	478	673.54	674.01
	A	7	84.13"	1.0061	.9989	.9869	1.0110	1.0049	12.87"	0.45	—	539	675.53	677.08
	Series A Average			1.0101	.9993	.9895	1.0119	1.0128						
7-12-54	Series B	8	84.52"	1.0110	1.0042	.9930	1.0166	1.0119	13.14"	0.46	.597	541	677.50	678.05
	B	9	65.89"	1.0113	1.0036	.9909	1.0164	1.0119	9.93"	0.34	—	477	678.05	678.57
7-13-54	B	10	51.13"	1.0130	1.0047	.9913	1.0163	1.0141	7.98"	0.28	.595	409	641.66	642.14
7-15-54	B	11A	37.61"	1.0158	1.0053	.9940	1.0171	1.0171	5.73"	0.20	.596	321	543.04	543.44
	B	12A	25.43"	1.0174	1.0046	.9973	1.0170	1.0108	4.08"	0.14	—	264	543.64	544.04
	B	13A	16.79"	1.0165	1.0048	.9958	1.0180	1.0209	2.66"	0.09	—	216	543.84	544.08
	B	14A	9.55"	1.0138	1.0056	.9987	1.0153	1.0190	1.58"	0.06	—	163	544.16	544.51
	Series B Average			1.0141	1.0048	.9944	1.0167	1.0151						
7-15-54	Series A (Check)	1A	8.90"	1.0093	.9997	.9947	1.0132	1.0199	1.36"	0.05	—	156	540.12	540.42
	A (Check)	3A	25.62"	1.0102	.9975	.9913	1.0133	1.0186	4.31"	0.15	.596	264	539.84	540.23
	A (Check)	6AX	65.70"	1.0068	1.0002	.9880	1.0114	1.0062	10.31"	0.36	—	423	540.62	541.04
	Series A (Check) Average			1.0088	.9992	.9913	1.0126	1.0149						
	Series A & A (Check) Average			1.0097	.9993	.9901	1.0121	1.0134						

*Includes manometer factor.
**Includes supercompressibility, manometer and specific gravity factors.

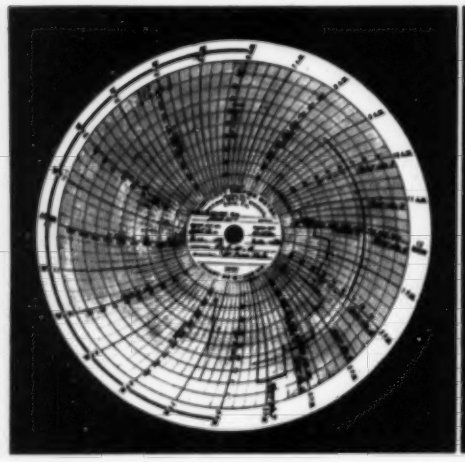


Fig. 13. Meter chart from 10-in. reference meter Run No. 2, Tests No. 1-7, 24-in. meter valve at Refugio.

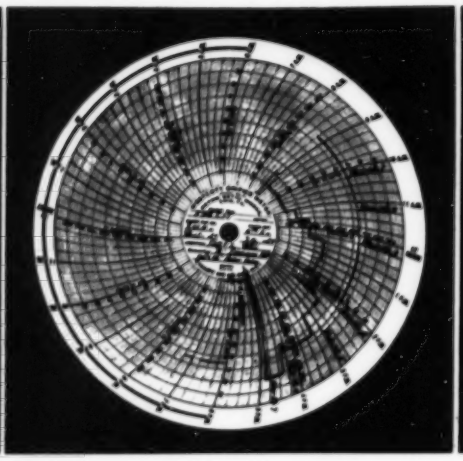


Fig. 14. Meter chart from 24-in. meter valve using pressure taps "A" and No. 2, Tests No. 1-7.

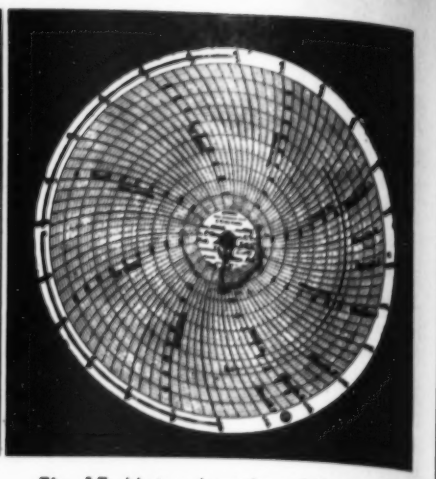


Fig. 15. Meter chart from 2½ and 8 diameter taps, 24-in. meter valve, Tests No. 1-7.

finding these larger valves satisfactory, we were naturally interested in checking the accuracy of still larger sizes. The fact that the American Gas Association's supervising committee for Research Project NX-4 for large diameter orifice meter tube tests had completed its test work at Refugio, Texas, and looked to dismantling this large volume test equipment spurred us to arrange to test a large diameter valve before the Refugio test assembly was removed.

Tennessee Gas Transmission Co., on whose line the large-diameter setup is located, cooperated with Southern Natural in the test, as did W-K-M, who made the valve. The AGA gave its permission for the use of the setup.

There being eight 10-in. reference meter runs at the Refugio test site, we decided to use a Beta ratio for the reference meters that would be well under the maximum prescribed by Report No. 2 for flange taps, yet enable us to use a large size meter-valve. A study of performance curves on the tests on the 4-in. and 10-in. valves indicated an optimum Beta ratio of around .61. Since a 24-in. valve with 23-in. ID inlet and approximately 14-in. throat would have a flow coefficient close to that of an 18.5-in. flange tap orifice in a 30-in. meter run, we decided to use a 24-in. valve. We then designed this valve and, as finally machined and micrometered to an inlet of 23.014 in. and a throat of 14.159 in., it had a calculated hourly coefficient of 93492.46 at 14.9 pressure base at .60 gravity and 60° F. Eight 10 in. by 6.4 in. orifice plates were decided upon for the 10.054 in. (avg. ID) reference meter tubes on which the sum of the flange tap coefficients was, on the same base conditions, 93333.68. The test flows would then give almost the same differentials on reference and test meters.

In order to check the differential gradient and metering characteristics of the throat, five pressure taps were located in the restriction cylinder. These were designated as Taps No. 1, No. 2, No. 3, No. 4, and No. 5. Nos. 2, 3 and 4 were O-ring-sealed between the gate segments and the body of the valve. *Fig. 7* shows Tap Nos. 1, 2, 4, and 5. No. 3 tap is located on the opposite side of the valve *(Fig. 8)*.

Two upstream taps were provided *(Fig. 7)*, the "A" tap at .481 d_2 and the "B" tap at .085 d_2 from the intersection of the upstream tube and the inlet to the convergent cone. Taps were also placed on the 24-in. run at 2½ diameters upstream and 8 diameters downstream from the valve to provide for data on the overall pressure recovery from the differentials developed in the valve throat.

When the design specifications were completed, W-K-M proceeded with the manufacture of the valve. In the meantime, 24-in. OD x 0.5-in. wall seamless tubing was selected from Tennessee's pipe stock to weld on for the pipe runs on each side of the valve. W-K-M welded 30 ft of this pipe on the upstream side and 11½ ft on the downstream side of the valve, making an assembly of approximately 48 ft overall, about the length limit that could be hauled from Houston to Refugio. After the pipe was welded on the valve, the welds were ground out on the inside as closely as possible to the surface conditions of the pipe and valve by W. B. Ruff and Thomas H. Oakes, of Southern Natural's measurement department, before the valve left W-K-M's plant. The 30-in. orifice fitting meter run immediately downstream from the loop header at the outlet of the reference assembly was removed and the 24-in. meter-valve run assembly was installed as shown in *Fig. 8*. All 24-in. field welds were ground out except the two end welds tying the 24-in. assembly into the 30-in. pipe. The internal conditioning of these welds was handled and inspected by Ruff and Oakes. The meter-valve assembly had 96 ft of 24-in. pipe on the upstream side and 60 ft of 24-in. on downstream side. No straightening vanes were used.

In order to have meter chart records of the test runs, all of the recording meters on the reference runs, as well as a meter for each of the meter-valve throat taps and the 2½ and 8 diameter taps, were conditioned and tested, as were the recording thermometers. The test manometers, gauge lines, cameras and all test equipment used in the large diameter tests were inspected and put in condition. The test on the meter-valve was set for the week of July 11.

In the final inspection of the test setup, the downstream sections of No. 1 and No. 8 10-in. reference runs were removed for tube inspections as representative of the reference run assembly. We had previously taken 10 of the 10-in. reference orifice plates used in the AGA NX-4 tests and had them rebored by Daniel Orifice Fitting Co. to the required 6.400-in. orifices. These stainless steel plates were ⅛ in. thick and were not bevelled. They were almost perfectly flat, none of them varying in excess of .002-in. in this respect. A certified indicating test thermometer was placed in the test well of each reference run

and in the test well downstream from the meter-valve.

On July 12, the first series of tests was run. Using the "A" upstream tap with the five throat taps, seven flows were run at manometer differentials on the reference tubes ranging from 9.22 in. to 84.13 in., at approximate intervals of one in the square roots of the differentials. The results of these tests are shown as the "A" series in *Table 3*; *Fig. 11* shows the curves on this series of flows.

The gauge lines on the meter-valve were changed from the "A" upstream pressure tap to the "B" upstream tap, and another series of seven flow rates was run with the "B" upstream tap at approximately the same differential intervals as were used on tests using the "A" upstream tap. The results of this series of flow rates are shown as the "B" series in *Table 3*. *Fig. 12* show the curves on the "B" upstream tap and the five throat taps of the valve. It will be noted that the coefficient of discharge on the five throat taps changed about ½ of 1% with the "B" upstream tap from that shown by the "A" tap. This was because of a slight increase of pressure in the impact of the flow as it reached the inlet to the convergent cone thereby slightly increasing the differentials, the "B" tap being closer than the "A" tap to the inlet of the primary device.

Following the seven flow rates with the "B" tap, the upstream gauge line was changed back to the "A" tap and three additional flow rates were run with this upstream tap with the average of the reference tube differentials at 8.90 in., 25.62 in., and 65.70 in. The results are shown in *Table 3*. These check tests on the "A" tap are represented by the blacked-in symbols on the curve *(Fig. 11)*. On these three additional flow rates with the "A" tap, the test pressures were 120 to 135 lb lower than on the seven flow rates with the "A" tap on July 12.

The flow rates on the 10-in. reference tubes were calculated on AGA Report No. 2, ignoring factor for specific gravity, it being identical on the reference tubes and the meter-valve, and supercompressibility and manometer factors as they were practically the same on both reference tubes and valve *(Fig. 9)*.

The flow rates on the meter-valve were calculated with expansion factors derived from Ø as already described and Reynolds number factors from AGA Report No. 2 (Eq. 20, 26, 29) for flange taps although the latter were of no significance in these tests on the 24-in. valve. As in the reference meter calculations, gravity, supercompressibility and manometer factors were not used *(Fig. 10)*; however, *Table 3* includes the Fpv, gravity and manometer factors in the M^2 24-hour rate for information on actual meter-valve capacity.

It will be noted, in measurement with the "A" upstream tap and No. 2 throat tap on this valve, that the value of the coefficient of discharge is practically 1.00. The volume measured by these taps varied from the eight 10-in. reference tubes less than 1/10th of 1% on the average of the seven flow rates ranging from 9.22 in. to 84.12 in. differential. The maximum individual variation in these seven flow rates was 33/100 of 1% on the plus side and 38/100 of 1% on the minus side *(Fig. 11* and *Table 3)*.

As a primary device the meter valve, so far as flexibility is concerned, has the limitation of a fixed coefficient. Our work on this has not contemplated the use of it in commercial measurement in place of the square-edged orifice. Its coefficient being fixed, it will serve accurately for the limited range of flow rates found in most transmission pipelines that operate at rather good load factors. Therefore, where the minimum flow doesn't fall below 30% of the maximum capacity, which would allow differentials between 9 in. and 95 in. to 100 in., we believe from our tests and operating experience, that the meter-valve will perform as accurately for pipeline check measurement as installations of conventional square-edged orifice metering equipment. In some respects, it has an advantage over the square-edged orifice:

1. If installed to serve as a block valve as well as a measurement primary device, the installation cost of metering with the gate valve is far less than the cost of a metering installation with the square-edged orifice.

2. The high coefficient value of the meter-valve is approximately 166% of the square-edged orifice of comparable d/D ratio and 122% of the highest d/D ratio that can be used in a flange tap orifice meter run. This high flow capacity favorably affects the economy of its installation.

3. Recovery of approximately 85% of the differential pressure developed in the throat of the valve for measurement purposes is an advantage over the square-edged orifice in pipeline operations. For example, with 82 in. or 2.96 lb differential pressure at the throat tap of a 24-in. meter-valve, the overall pressure loss between a point 2½ diameters upstream and 8 diameters downstream from the valve will be only 12.5 in. or .45 of a pound (see *Figs. 14* and *15*) while the same volume over a .7 flange tap square-edged orifice (the largest that may be used under Report No. 2) in the same size meter run would create 121.5 in. differential or 4.39 lb, only 49% of which would be recovered, or making a loss of 2.24 lb. This individual loss may seem small in a high pressure transmission line but it has to be made up in horsepower on a compressor if the deliverability of the pipeline is not to be reduced.

As for other uses for the meter-valve than for pipeline check meters, as we have initially used them, it is possible that these phases of the industry may find them of value:

1. For the measurement of input and withdrawals on gas storage projects. As the meter-valve has the same dimensional cones and transition characteristic from cone to throat on each side of the throat, it can be made to serve as accurately for a two-way flow meter as it will in one direction only.

2. The use of the meter-valve seems to have possibilities as a differential device for the proportional introduction of odorant into gas distribution or transmission lines, at the same time providing a means for recording the flow. Gas distribution systems, too, might find the meter-valve of value in particular sections of the plant system where a shutoff valve is required, and where almost complete pressure recovery is desired and information on the rates of flow is useful.

3. There are points in the piping layouts of industrial plants where the addition of metering characteristics for gas or liquid flows in a required shutoff valve would be of value, especially in petroleum refining and the chemical plants, either for intermittent observations of flow or in regular recordings.

In our view, the meter-valve, as we have experimented with it, has three main features: the shape with its cone and throat relationships can be accurately reproduced in manufacture so that its coefficient can be calculated and accurate metering done without calibration of the individual unit; used in places where shutoff valves are required, the design of the shape of this primary head meter device into the valve body provides a facility for flow information at a much lower installation cost than can be done with the square-edged orifice; and it measures the flow with almost no pressure loss in the pipe system. ■

U. S. Patent No. 2,693,110 and Petent Pending.

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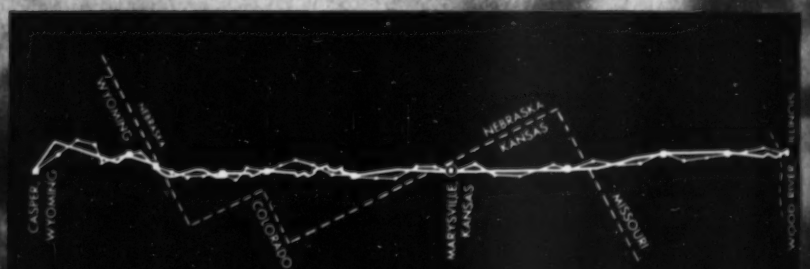

Platte microwave repeater station at Midway, Wyoming.

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Drilling craft from the upstream side.

The miniature geyser in the center of the picture appeared when air was blown down through the drill steel to clear the hole of cuttings.

Underwater Excavation Speeded with Piston-type Shot-Hole Drills

BARGE-MOUNTED, compressed air-operated piston drills punched a dynamite hole every 58 minutes in the lime-stone-quartzite bottom of the Susquehanna river at a point two miles north of Marietta, Pa., when a 12-in. line was laid underwater for Manufacturers Light & Heat Co.'s 2100-ft river crossing. The crossing is a link in a new line that carries natural gas from Texas Eastern Transmission Co.'s Metering Station 24A, on the east bank of the river, to Manufacturers' distribution system located a few miles westward, serving the Lancaster-York area of Pennsylvania.

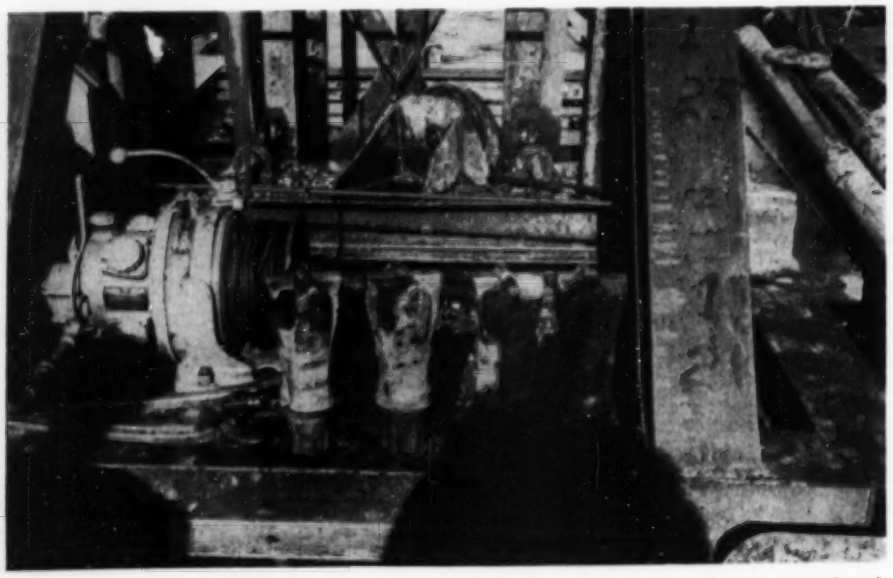
Specifications for the job called for 1200 ft of underwater excavation to a depth that would afford the ⅜-in. wall thickness, 12-in. diameter welded steel pipe not less than 3 ft of cover. The crossing contractor, Missouri Valley Dredging Co., elected to drill the river bed shot-holes to an average depth of 12 ft to assure the pipe being provided with the specified cover. The holes were spotted in two parallel rows with 6-ft intervals between holes. The rows were planned to run about 5 ft apart and the shot-holes in each row were staggered in relation to those in the opposite row.

Bank drilling

The drilling on the banks was done with conventional drifter-type hammer drills swung from tackle, handled by side boom, crawler-type tractors, but floating equipment was necessary from water's edge to water's edge, because the Susquehanna was confined to a width of 1200 ft with a maximum depth of 15 ft at the time of the crossing construction.

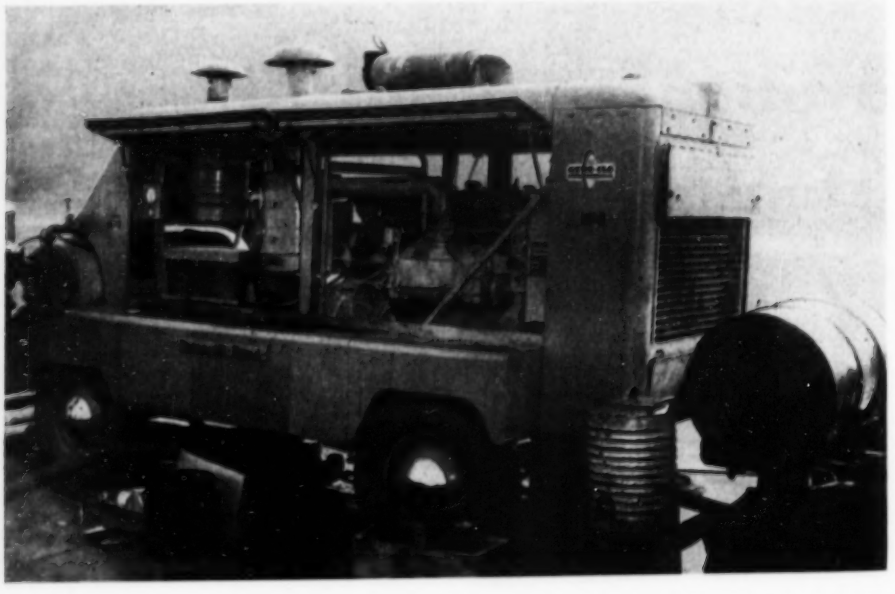
Missouri Valley Dredging had a choice of several types of drilling rigs to apply to the work; however, it chose a method that had been tried and proven by Pentzien Inc. while laying a dual natural gas line crossing in the same river near Harrisburg, Pa. Pentzien used a piston-type submarine drill mounted on a tower erected on a barge. Compressed air was supplied by a portable compressor. Missouri Valley decided to use the

Underwater drilling . . . Eight holes could be drilled in the trip from end to end



Four of the seven Carset bits as they looked three days before the job was completed, with much service left in them. The bit at the right and the second one from the left show inward curves on top.

Each barge carried one of these Ingersoll-Rand 600-cfm Gyro-Flo portable compressors to power the drill and hoists.



same type of drill, but modified the barge arrangement to provide for mobility of the drilling tower.

The primary barge used in the drilling phase was assembled from eight steel pontoons, 7 ft wide by 26½ ft long, arranged four abreast and two lengthwise. The steel tower or drilling rig was 45 ft tall and about 8 ft square at its base. Each corner of the base was carried on an 8-in. wheel; the two front wheels, in relation to the derrick, were flanged so that they would run on a standard railroad rail that was laid along one side of the barge. Rear wheels were flat-faced to travel in 2-in. by 2-in. steel channels welded to the top and bottom of a steel I-beam, which was, in turn, welded to the structural members of the barge decking. In effect, the flat-faced wheels, traveling in the top and bottom housings formed by the channels, prevented the derrick from tipping when heavy strains were placed on the overhead structure.

With this traveling drilling tower arrangement, eight shot-holes (and in some cases, nine) could be drilled in the journey from one end of the barge to the other each time the barge was positioned. The tower was moved with spun-wire cable handled by an American single-drum, electric-drive winch. The barge was powered by winch-operated wire lines, one for each corner of the craft, bended to four 10-ton concrete deadmen sunk in the river—two upstream and two downstream. The cables were spun in or paid out by a fishing-vessel type, four-drum winch driven by a Ford industrial gasoline engine.

This mooring and moving technique allowed the barge to be positioned so that one set of shot holes for the downstream row could be drilled, then the barge was moved 5 ft upstream and the second line of holes could be drilled. Following completion of the drilling in both rows from one barge position, the barge was moved laterally a distance equalling the length, and the drilling cycle was repeated.

An Ingersoll-Rand SD-65 piston-type submarine drill, weighing 2500 lb, was mounted on a 5700-lb slabback that ran in guides on the front of the derrick. The drill was supplied compressed air at 100 psig from an Ingersoll-Rand Gyro-Flo portable compressor rated at 600 cfm. The SD-65 drilled satisfactorily at this pressure, although 125 psig is ideal for this machine. Facilities were provided for setting and pulling sand pipe, casing, etc., and for blowing cuttings out of the holes with compressed air. Ingersoll-Rand air hoists were used to raise and lower the drill and slabback, and to handle sand pipe, casing, etc.

Bad weather

The drilling operations were not started until Oct. 24, 1954, and the drilling contractor had to push the job as it was feared that winter floods and freezing weather would delay or damage the project. It had originally been planned to construct a second drilling rig on the prime barge, but this would have necessitated halting the drilling to bring the craft to shore, so the contractor adopted the time-saving idea of fabricating a second, smaller barge with a stationary drilling derrick. Basically, Barge No. 2 was similar in design and equipment with its predecessor except that the tower lacked mobility, drilling was done at a block-U-shaped opening in the for-

Continued on page 148

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CLARK TURBO-*SUPER*CHARGING

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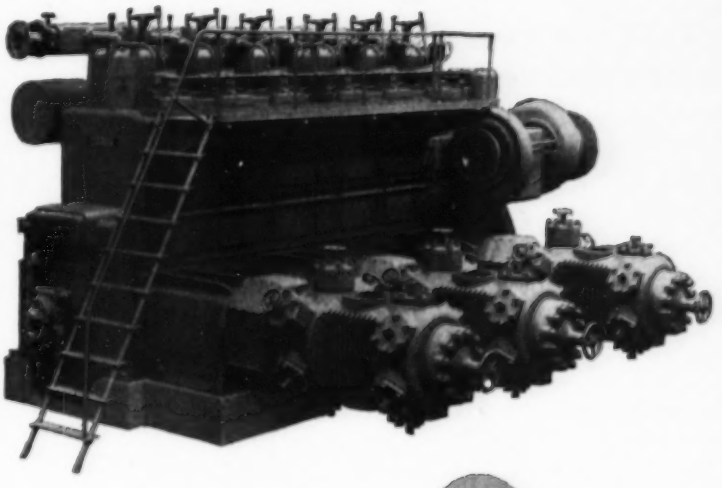

Clark sets the pace in compressor progress

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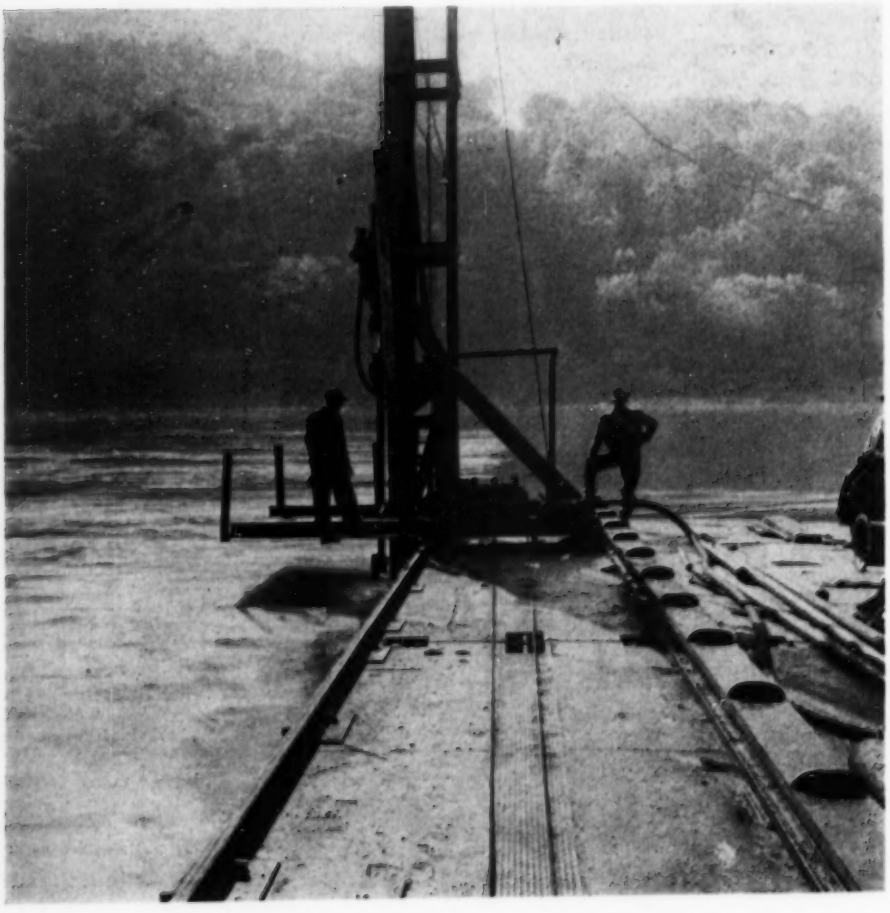
The pipe, which is shown here running back through the woods, was floated into position, welded into a continuous section, and sunk into the trench in the river bed.

Details of the tower with the drill mounted on a slabback running in guides between the two forward vertical members are seen at 13 ft. Projecting above the water in the foreground are two pieces of casing in drilled holes.



ward unit, and two small winches provided the barge mobility. It is interesting to note that the second barge derrick will be fitted with wheels, when time permits, and that both barges are designed to allow ready dismantling so that they can be moved to other job sites by truck.

At its Marietta crossing, the Susquehanna courses over bare rock in places, but there is usually a cover of several inches to a foot of eroded gravel, silt, fine coal, and other alluvium. The bed rock was predominantly limestone; however, quartzite was found near the stream's center and a short stretch of shale was encountered near the west bank.

To speed the drilling, a barge-mounted rotary drilling rig was put into service while Barge No. 1 was being fitted out. The rotary rig drilled 78 shot-holes before it was removed from the operations. The remaining 379 holes necessary for the successful blasting were drilled by the two piston-drill barges; that is, Barge No. 1 was able to drill 321 holes from Oct. 24 to Nov. 11, while No. 2 drilled 58 holes during the four days it was in service on the project. The No. 1 barge averaged 54 minutes per hole, and the No. 2 barge averaged one hole every 83 minutes. These records produced the over-all average of 58 minutes per hole.

All of the drilling was accomplished with seven Carset (tungsten-carbide insert) bits. Collectively, they put down 4548 ft of hole with a record of no broken or wornout bits.

The alluvium was denied entrance to the shot holes by drilling in a sand pipe that was floored on the limestone bottom of the river. After each hole reached final depth, a 5½-in. diameter casing was landed in the bottom by pushing with the piston-drill. The casing was long enough to reach from the bottom of the hole to above the water surface, so it served to preserve the hole and mark its position until it was loaded and shot.

Charges used for the blasting usually were two or three 16⅔-lb cartridges of 60 or 75% dynamite per hole. Approximately 17,000 lb of explosive was touched off during four separate firings. The spoil was mucked out of the trench with barge-mounted draglines and backhoes, and layed in spoil-piles alongside the trench to facilitate backfilling.

Triple-joint sections of pipe were welded up on the bank before being floated into position over the trench. Concrete river weights, weighing 1400 lb in air and producing 789 lb of negative buoyancy, were bolted on the pipe before the triple-joint pipe segments were welded and sunk in place in the trench. ■

Adapted from "Compressed Air Magazine," Phillipsburg, N. J.

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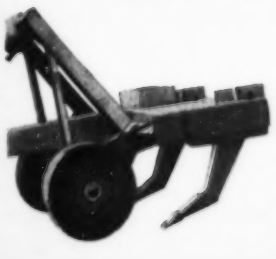
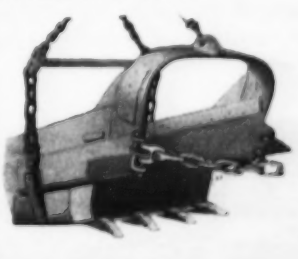




Can you move a 52-ton cooling tower? United Gas tells how it did it—

Problem: A 104,000-lb cooling tower is located 1200 ft from where it ought to be. Should it be junked or dismantled and moved piece by piece?

Solution: Neither. Pick it up and move it—as a unit.

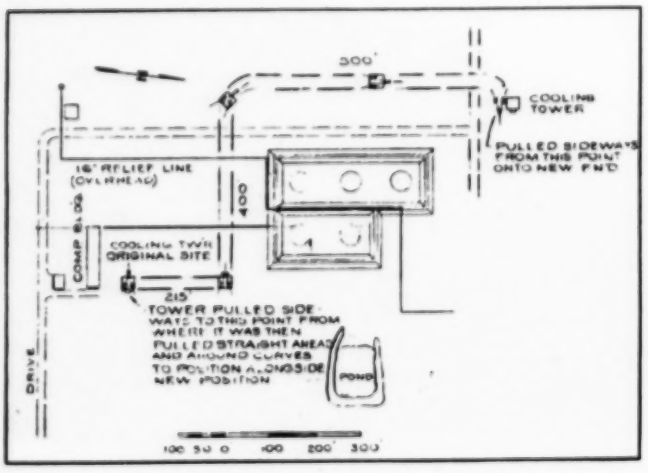
THAT'S what engineers at United Gas Corp. decided to do with an induced draft tower located at its Carthage station when the station, under United's expansion program, was being enlarged and the tower proved too small to handle increased outlet gas cooling needs. Fortunately, the tower could be put to good use in cooling regeneration gas at a dehydration unit located some 1200 ft distant. But how to get it there?

The cooling tower manufacturer recommended that either the tower be dismantled and rebuilt on the new site or a new tower be purchased. But United was acquainted with an experienced mover in the area, who had previously raised a similar tower intact. He agreed to undertake the job.

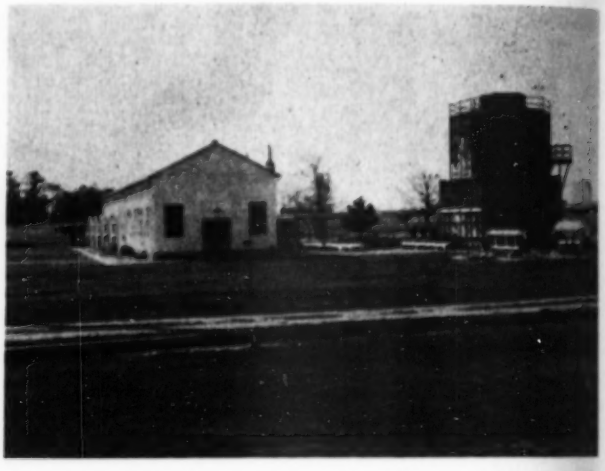
The tower is a Fluor 1CFND x 125 — 24 x 24 DD induced draft, 4-bay, single-cell unit with overall dimensions of 25 ft by 25 ft by about 35 ft high, equipped with a coil shed to accommodate atmospheric coolers. The weight of the tower when wet was given as 104,000 lb and since the tower was operating up to the time the job of moving began, the weight in transit was nearly that great.

About 500 man hours were required to install the necessary supports, move the tower, lower and secure it on its new foundation. The total labor cost of removing the coolers, piping and the coil head of the old tower, moving the tower, building the new basin, replacing the coolers and piping was less than $9500. Three days of expert services were required of the moving contractor and cooling tower erection engineer. It was estimated that the cost of tearing down the old tower, rebuilding it and replacing the broken members would cost almost as much as a new tower. It is estimated that $10,000 or more was saved by moving the tower instead of tearing it down and rebuilding it or purchasing a new one for this service.

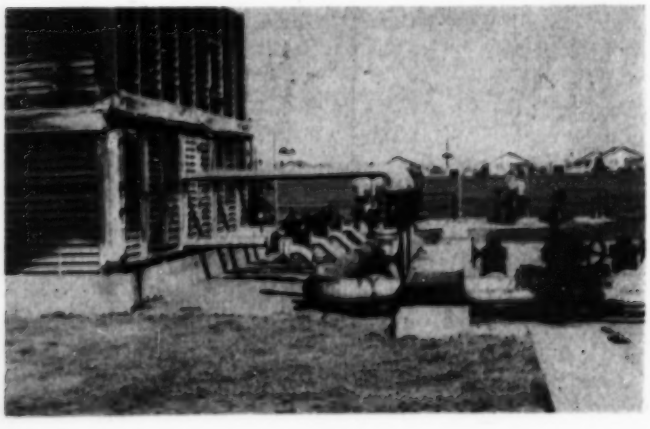
How preparations for the job were made, and how the moving was accomplished are told in this picture story.


300'
COOLING TOWER
PULLED SIDEWAYS FROM THIS POINT ONTO NEW PAD
16" RELIEF LINE (OVERHEAD)
400
COMP. BLDG.
COOLING TWR. ORIGINAL SITE
215'
TOWER PULLED SIDEWAYS TO THIS POINT FROM WHERE IT WAS THEN PULLED STRAIGHT AHEAD AND AROUND CURVES TO POSITION ALONGSIDE NEW POSITION
POND
DRIVE
100 50 0 100 200 300

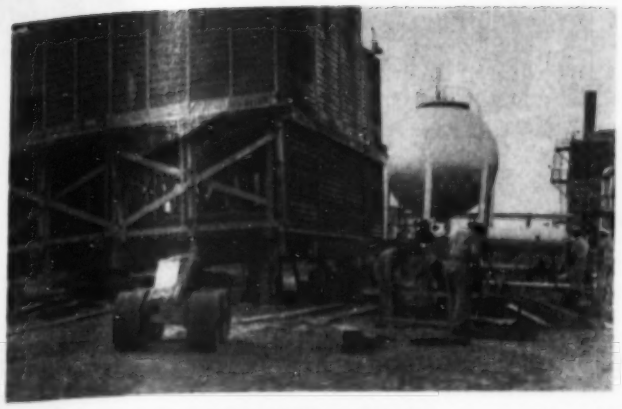
Route of the move, from the original site (at left) to the new site, right. Tower was towed sideways as well as forward, and around corners.



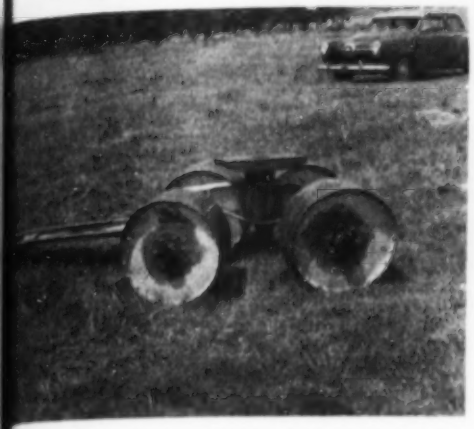
Cooling tower is shown in its original location before preparations were made for the move.



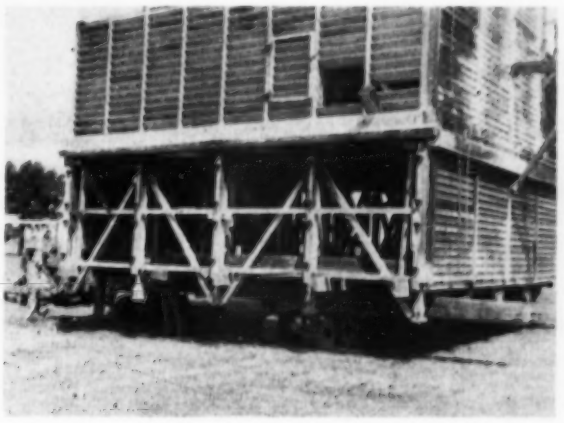
Section of tower showing detail of lower section and concrete basin. The first steps in readying the tower for its journey included the removal of the coil shed framing, gas coolers, gas and water piping, and other connections securing the tower to the foundation and the ground. The mechanical and electrical equipment, however, such as the fan, conduits and lighting fixtures were left intact on the tower. The concrete curbing forming the basin under the tower was broken out to ground level. A supporting horizontal temporary deck of five 6-in. by 8-in. by 26-in. timbers was placed above the top of the former concrete basin. Vertical 4-in. by 4-in. wood members were then secured between the temporary horizontal deck and distribution deck of the tower. These vertical 4- by 4-in. temporary uprights were rigidly cross braced to each other to the vertical tower supports and horizontal decks.



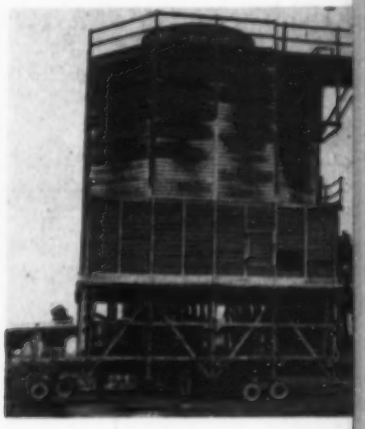
After the 6- by 8-in. horizontal deck and temporary supports were properly secured, jacks were placed under one end of the 6- by 8-in. timbers and the tower was jacked up about 6 in. and then blocked. The jacks were then removed to the opposite end of the timbers and that end was then jacked and blocked approximately the same amount. This jacking and blocking procedure was continued until the tower had been raised sufficiently to permit two 12-in. by 12-in. by 40-ft long running sills to be placed to form a V under the 6- by 8-in. timbers and thus to accommodate a three-point support for the tower. To hold the sills in this position, the sills were chained to each other where they came together, and where they were spread apart they were also chained to keep them from spreading farther apart when the tower was pulled sideways. The jacks were then transferred under the running sills and the tower was jacked up alternately so that the three sets of dollies could be placed under the running sills in the position desired.



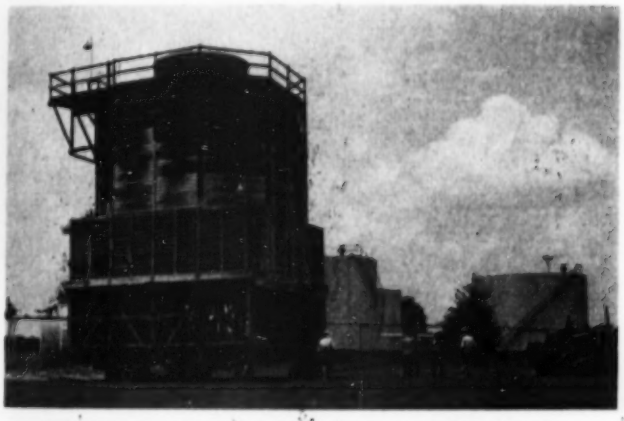
Dollies which bore the load were 4-wheel units, made up similar to a carriage, with fixed rear axle and a movable front axle. Four 24-in. diameter, 12-in. steel face wheels were used, with a table mounted on a ball-and-socket joint and the tongue connected to the front wheels. The manner in which the table was mounted to form part of the socket allowed the load to be carried over slightly uneven terrain without difficulty.



The first move was sideways, and here the dollies are set to move the tower in that direction. Positioning of the dollies was achieved by the use of jacks under the running sills, which relieved them of the tower load.

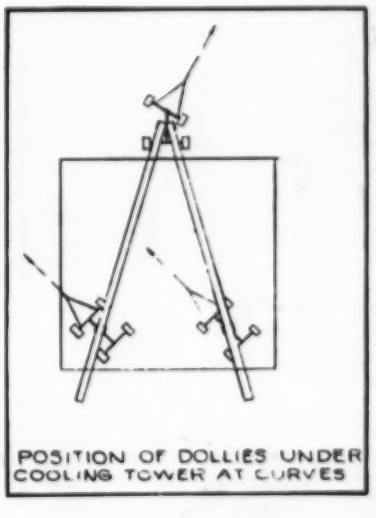


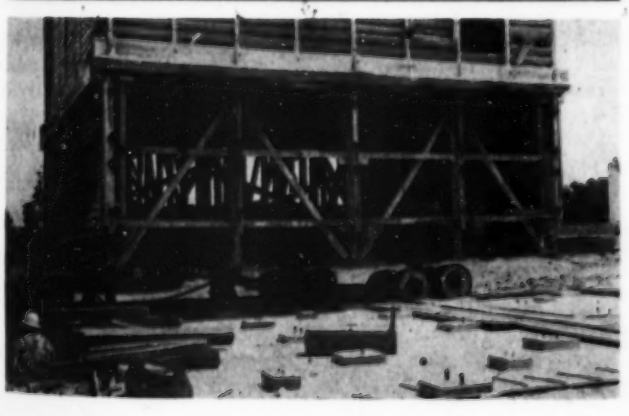
Here the tower moves straight ahead. Where it was necessary to cross ditches or very uneven ground, the low spots were dirt-filled and planking was laid across them.



It was necessary to move the tower around 90-deg. corners. Note positioning of dollies, with front dolly pointing along a tangent to the curve and rear dollies pointing out.

The way the dollies were positioned under curves is shown in this sketch. Three men at each tongue (which were extended by use of 2- by 6-in. timbers) directed the movement of each dolly.

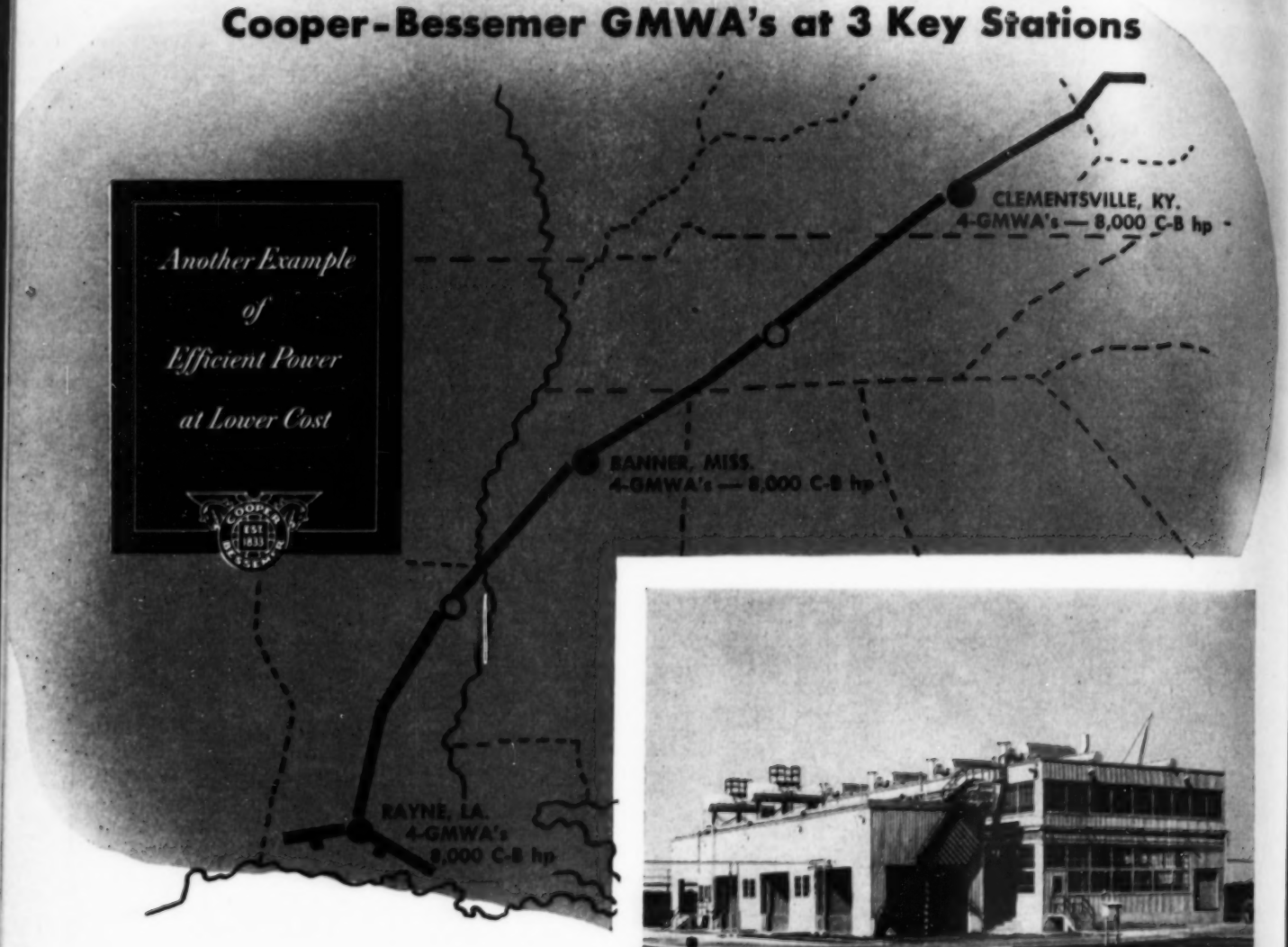




Tower is shown ready to be moved onto the new foundation. Concrete supports and floor of the basin are being prepared to receive it. Note reinforcing steel running through walls to floor of basin. Provision was made in the tower floor to install the sidewalls of the basin after the tower was secure in its new foundation. After the tower was set in the proper position over its new location, it was alternately jacked up—first to remove the dollies and second to remove the running sills, and finally to remove the temporary horizontal decking and the temporary supports and bracing.

PUSH-BUTTON OPERATION

on Gulf Interstate's Mainline... with Cooper-Bessemer GMWA's at 3 Key Stations



● Main compressor building of the 8,000 hp Cooper-Bessemer powered Rayne station.

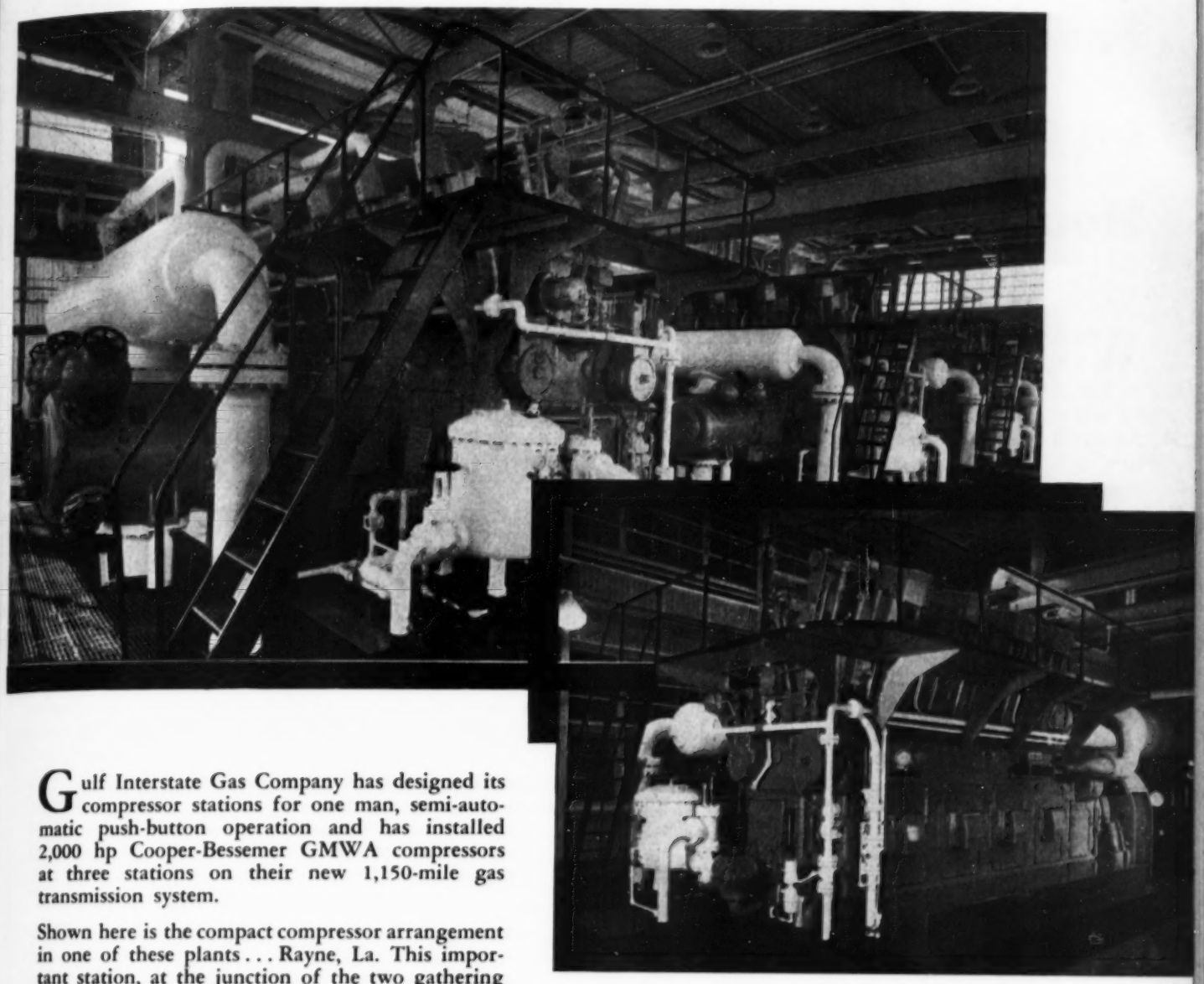
ANGLE

Compressors

New York Washington, D. C. Bradford, Pa.

San Francisco, Cal. Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle, Wash.

● Shown here from the compressor cylinder side are four of the GMWA compressors used in Gulf Interstate's transmission of natural gas from fields in southern Louisiana to West Virginia.



Gulf Interstate Gas Company has designed its compressor stations for one man, semi-automatic push-button operation and has installed 2,000 hp Cooper-Bessemer GMWA compressors at three stations on their new 1,150-mile gas transmission system.

Shown here is the compact compressor arrangement in one of these plants . . . Rayne, La. This important station, at the junction of the two gathering laterals and mainline starting point, is equipped with four 8-cylinder GMWA units, identical to those in the Banner and Clementsville stations. Each of these Cooper-Bessemer installations offers top automatic operating efficiency without sacrificing flexibility.

Helping push natural gas to the northeast, these dependable Cooper-Bessemer units can be relied upon to deliver continuous top availability, low operating expense, unmatched compressor flexibility and minimum maintenance demands.

● Line-up of four Cooper-Bessemer 2000 hp GMWA V-angle units in Gulf Interstate's Rayne, La. station.

All the latest Cooper-Bessemer V-angles . . . GMXA's, GMVA's, GMWA's . . . are ready to help *you* cut costs on heavy-duty compressor requirements from 200 to 3000 hp. For further information, contact the Cooper-Bessemer office nearest you.

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Boost from the president's committee

Favorable action on gas act changes seen as House committee starts hearings

WITH the favorable report of the President's Advisory Committee on Energy Supplies and Resources Policy leading the way, developments throughout the country—and particularly in Washington—seemed last month to be swinging the pendulum toward the position of the producers in the battle of controls vs. free enterprise at the wellhead.

The cabinet committee report flatly recommended the lifting of controls in these words:

"In the production of natural gas it is important that sound conservation practices be continued. This area of conservation management is under the jurisdiction of state conservation commissions. In the interest of a sound fuel policy and the protection of the national defense and consumer interests by assuring such a continued exploration for and development of adequate reserves as to provide an adequate supply of natural gas, we believe the federal government should not control the production, gathering, processing, or sale of natural gas prior to its entry into an interstate transmission line."

It will be recalled that submission of bills favoring the producer's position has been withheld for several weeks pending release of the report, and that sponsoring Congressmen had finally released their bills after it appeared that the much-delayed report might be indefinitely bottlenecked in the Administration.

Almost immediately upon release of the advisory committee's report, two bills that were closely tailored to its recommendations were introduced in the House. The first was the Harris bill, sponsored by Rep. Oren Harris, Arkansas Democrat, and ranking member of his party on the House Commerce Committee. The bill would give FPC authority to control gas sales only after their delivery into interstate transportation facilities. Beyond this, the bill would inject a sort of roundabout controlling producer prices to prevent any runaway in contract charges. According to its terms, when an interstate gas company seeks a rate increase on the basis of a new contract to buy gas from a non-affiliate, FPC shall allow as an operating expense the reasonable market price in the field where the gas was produced, plus a fair gathering charge in cases where the field price does not include this item. The same price would be allowed in cases of proposed rate increases covering gas that an interstate gas company produces itself through a subsidiary or buys from an affiliate. Any price greater than such prices would not be allowed as an "operating charge."

These latter provisions would protect the customer by establishing a fair basis for determining gas company rates, according to Representative Harris.

An identical bill was introduced shortly thereafter by Rep. Hinshaw, California Republican.

The advisory committee's report spoke of a "reasonable market field price" in laying down recommendations for commission policy. Said the report:

"The interstate transmission of natural gas by the interstate transmission lines and the subsequent sale of such gas for resale is a public utility function and should be under the regulation of the Federal Power Commission. In considering the certification of new lines and applications for increased rates based on new or renegotiated purchase contracts, the commission should consider, in order to provide protection for the consumer, not only the assurance of supply but also whether the contract prices of the natural gas which the applicant has contracted to buy are competitively arrived at and represent the reasonable market field price, giving due consideration, in the interest of competition, to the reasonableness and appropriateness of contract provisions as they relate to existing or future market field prices."

The committee also stated that "each operation of such companies (that engage in more than one activity—production, transmission, distribution) should be treated . . . according to its appropriate industry function."

The advisory committee also took a firm stand on sales below cost by interstate pipeline companies in these words:

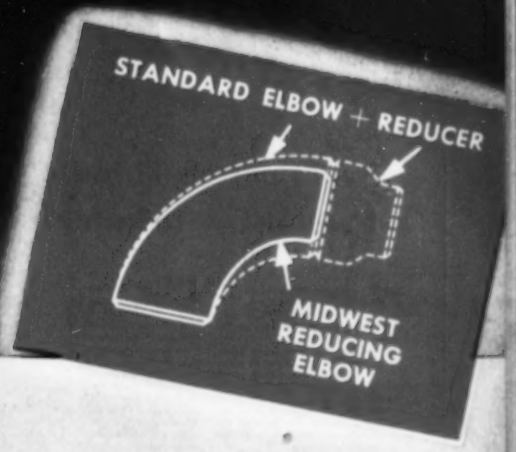
"The basic principle regarding the regulation of natural gas and the use of alternative energy sources should be as far as possible that of free choice by the consumer and free and fair competition among suppliers. This, it is confidently thought, will provide most effectively for the assurance and flexibility of energy supply, both for economic growth and strong security readiness. But sales either for resale or direct consumption below actual cost plus a fair proportion of fixed charges which drive out competing fuels constitute unfair competition and are inimical to a sound fuels economy.

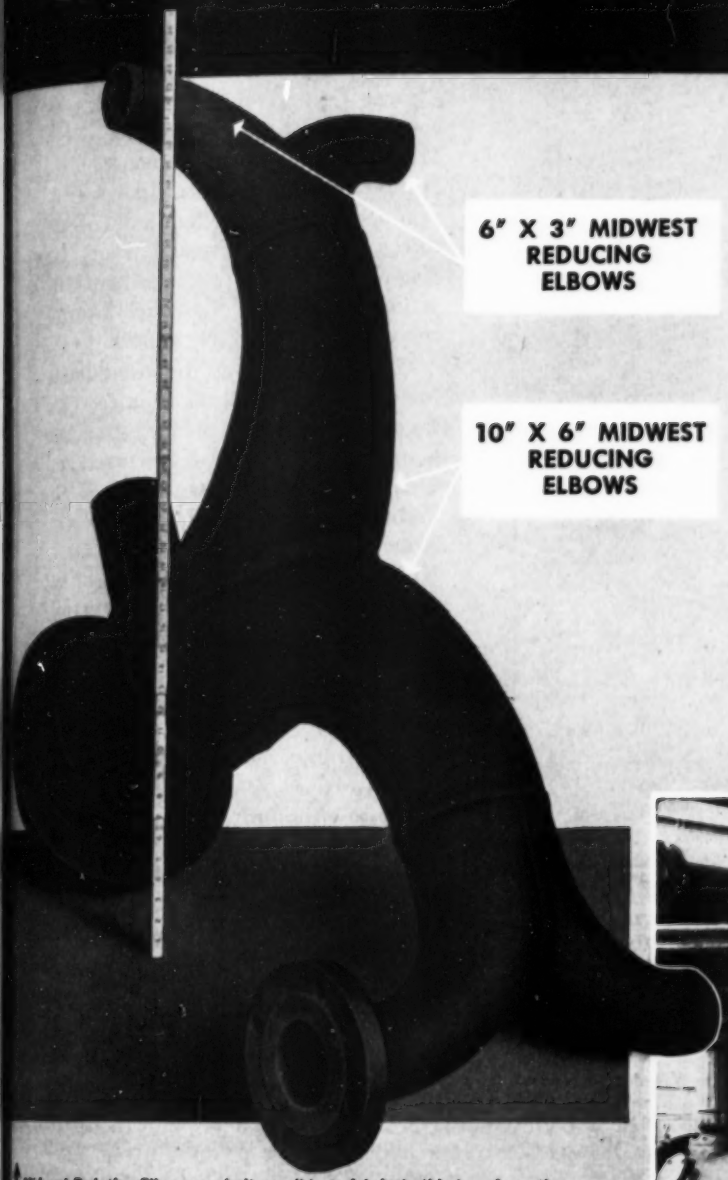
"The committee recommends, therefore, that appropriate action be taken that will prohibit sales by interstate pipelines either for resale or for direct consumption, which drive out competing fuels because the charges are below actual cost plus a fair proportion of fixed charges."

How this policy might be implemented was not stated in the report.

While the Harris and Hinshaw bills were only two among a dozen or more that have already flooded the hoppers, they were being voted "most likely to succeed." The "reasonable market field price" provision may be the concession to regulation needed to swing over some

Better Piping at a Better Price by Using MIDWEST REDUCING ELBOWS





6" X 3" MIDWEST REDUCING ELBOWS

10" X 6" MIDWEST REDUCING ELBOWS

The Midwest Reducing Elbow offers important advantages in both piping design and piping cost. It needs only two welds instead of the three required by a standard elbow and a reducer (see sketch above). There is also a saving in layout time. Turbulence and pressure drop are reduced by the gradual taper . . . less space is needed . . . insulation is easier . . . and piping appearance is improved.

Only Midwest Reducing Elbows are available from stock in sizes to 16" . . . larger on special order. They have the same dimensional accuracy, uniformity of wall thickness, exact included angle and true center-to-end dimensions of Midwest Straight Elbows. For further information, ask for Catalog 54.

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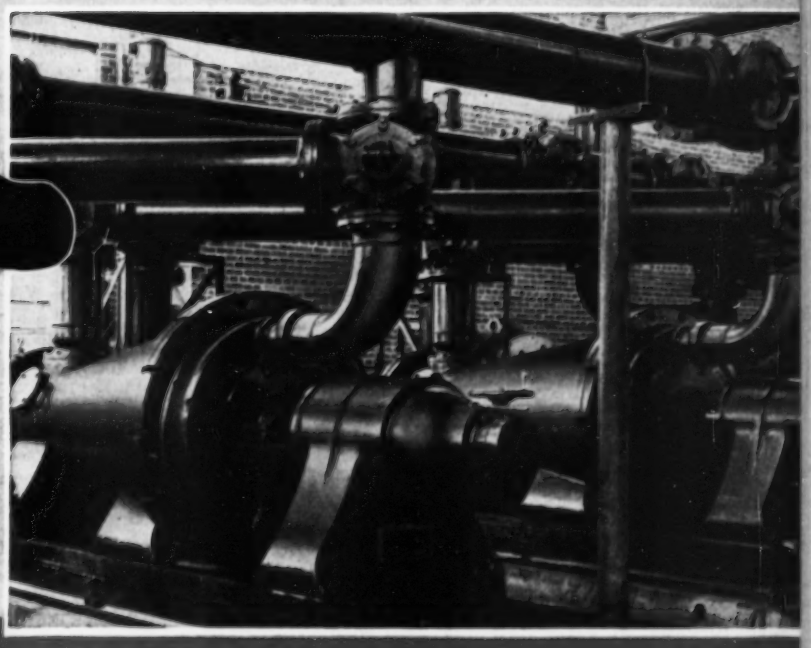

Midwest Reducing Elbows made it possible to fabricate this transformation piece for a boiler feed suction line so that it could be installed in the limited space available and still get the benefit of streamline flow. There was also a cost saving in comparison with a less efficient and bulky assembly made with straight tees, ells and reducers.

→ Paper stock flows with minimum resistance through Midwest Reducing Elbows from 8" connection on Jordan to 10" header. Other advantages over standard elbow and reducer: a saving in cost and space, and improved appearance.

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EDITORIALS

Will Controls Throttle Natural-Gas Industry?

DUFFY'S CARTOON

THE TREND

Industry Can Do It Better

Reprinted by Special Permission from BUSINESS WEEK, February 5, 1955

Two of the more important media that have swung behind the producers are Business Week and the Saturday Evening Post, whose editorials are shown above.

of the milder opposition, it was felt.

The apparent improvement in the position of the producers was not the result of any lessening in the volubility of the regulationists, but rather in the increasing volume of the many voices being raised in defense of free enterprise at the wellhead. Senator Kefauver was pretty angry with the advisory committee for what he termed its "weasel words." Sen. Paul Douglas, Illinois Democrat, who was loud in his protests of the Kerr bill of several years ago, dropped in a bill similar to that introduced earlier by Rep. Yates, another Illinois Democrat. Both would clamp original-cost-depreciated rate-making formulas on producers.

And in Wisconsin and other nearby gas-consuming states, efforts to defeat the Harris bill and others of its nature were being accelerated. The Madison *Capital Times* was asking editorially, "Is the whole country to be given away to Texas and other oil interests?" City and state officials were gathering their forces for a battle in Washington. A committee of municipal law officers organized by Waukesha (Wis.) City Atty. William G. Callow was drafted to take their story to the nation's capital. Other members of the committee included John Banks, city attorney of Denver, Colo.; David M. Proctor, city counselor of Kansas City, Mo.; John Mortimer, corporation counsel, Chicago; James H. Lee, utilities corporation counsel, Detroit; Ralph S. Locher, director of law, Cleveland; Harry G. Slater, first assistant city attorney, Milwaukee; and Peter Campbell Brown, corporation counsel, New York.

Calling themselves the "Consumers National Municipal Committee," the municipal legal men planned to call on Senators Wiley (Wis.), Kefauver, and Douglas, and Reps. Glenn Davis, Waukesha Republican, and C. J. Zablocki, Milwaukee Democratic. Rep. Davis later wrote the President, urging that the Administration make no "commitment" on the bills until a conference could be arranged.

The committee was also scheduling testimony for the Commerce Committee hearings, which were on the calendar for March 22.

Despite the flurry of excitement, industry sources were not looking for any speedy action on the bills. Somewhat battered by charges of "giveaway" in past skirmishes with the Democrats, the Republican senate leaders were promising to let the Democrats handle this particular hot potato—although Rep. Charles A. Halleck, assistant House Republican leader, indicated he would support the decontrol bills.

Judging from response to date to the educational campaign of the Natural Gas & Oil Resources Committee, a modicum of delay will prove helpful to the producers. Activities of this industry group are continuing at a fast pace, and editorial support was steadily increasing on a rather wide front. Among supporters lined up behind the producers were the New York *Herald-Tribune*, the Boston *Post*, Bakersfield *Californian*, Columbus (Ga.) *Ledger*, Mason City (Iowa) *Globe-Gazette*, Reading (Pa.) *Eagle*, Westerly (R. I.) *Sun*, Minneapolis *Star*, and many others. ■

"Competition will regulate prices very well in a free market, in fact, there is no better regulator known. If the gas companies can show actual competition comparable to that in the production and distribution of coal and oil, they will make their point. However, there is much force to the contention that for Wisconsin there is but one source of gas and that is at the wellhead of the Phillips Petroleum Co., of Bartlesville, Okla. There are many other producers of gas in the southwest but the Wisconsin-Michigan pipeline is tied to the Phillips company and there is no way to reach other suppliers.

"The high rewards paid to producers have resulted in the discovery of many new fields such as those in North Dakota and Canada but as there are no pipelines from them to Wisconsin the competition is potential but ineffective."

The position of Wisconsin officials who are leading the fight against producer bills is stated in this excerpt from an editorial in the Appleton Post Crescent.

When PRICE FIXING grabs one Industry . . . How long can others hold out?

PRECEDENT is being set for government price control of an industry. If price fixing by FPC could be accepted as applying to natural gas only, the decision of the Supreme Court in the Phillips case would be a matter of less national and individual concern. The threat in this throttling decision to other industry, and the sovereignty of States appalls most students of the Constitutional guarantees of free enterprise.

The Natural Gas Act of 1938 has this wording in its jurisdictional section:

"The provisions of this Act . . . shall not apply . . . to the production or gathering of natural gas."

In eleven instances the Federal Power Commission itself accepted this interpretation by ruling it had no authority to fix the price of gas in the field. One such decision in 1951 was carried into the courts as the Phillips case; and in June, 1954, the Supreme Court ruled that under other wording of the Statute, the Federal Power Commission can regulate or fix the price of gas sold by a producer to a natural gas (pipeline) company in an interstate sale.

The implications of this decision were summed up by Governor Allen Shivers of Texas before the Interstate Oil Compact Commission in Chicago, like this:

"The Supreme Court's rule, in the Phillips decision, overturns all the precedents of our national experience by removing from the States the right to exercise the police powers reserved to them by the Tenth Amendment as a part of the Sovereign Bill of Rights.

"This is a drastic change, an unwanted and an unwarranted change, a change which I do not believe the people of the United States are willing to accept . . . If the power of the federal government can reach to the well heads of oil and gas fields in Texas and Oklahoma . . . it can likewise reach to the crop rows of Iowa, the dairy sheds of Minnesota, the mine faces of Illinois and wholly change the character of private enterprise as well as the character of the government of this land of ours."

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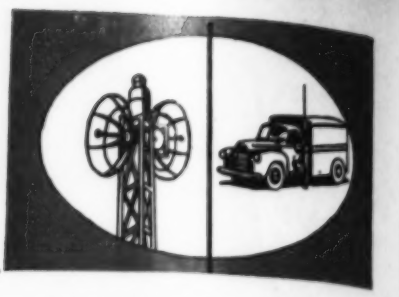


By FRANK CHAPMAN

Data handling techniques promise to broaden industry's communications

THE current trend toward wider use of telemetry and remote control in the gas industry, while promising to considerably broaden the scope of the industry's communications facilities, may at the same time place requirements on these facilities that are more stringent and unusual than any that have been encountered in the past. This is particularly true since the trend toward wider use of telemetry and remote control has been fostered in large part by a group of manufacturers who, although thoroughly familiar with the field of communications, are in many instances unfamiliar with the operations of the gas industry. These manufacturers are the ones who have taken an interest in the development of analogue-to-digital and digital-to-analogue equipment of various types to provide the link between the metering and control processes and some medium of communication.

An exchange of information and ideas between those who are responsible for the industry's communications and the designers of terminal equipment would be mutually beneficial. In the broad sense it would provide a common meeting ground that would serve to make both the industry's communications facilities and the telemetric and remote control equipment of greater value. Specifically, a common understanding would help gas industry communications engineers to better design their systems to accommodate telemetric and remote control facilities. Designers of equipment, on the other hand, with a better grasp of the requirements of the industry would be in a better position to develop equipment for the industry's peculiar needs.

This "common understanding" is not as yet a reality. On one side of the picture, industry communications personnel are occupied with current problems to the extent that they are kept from taking the time necessary to acquaint themselves with the manufacturers and specifications of available equipment. Equipment designers and manufacturers, on the other hand, although fully cognizant of the need to become better acquainted with the gas industry's problems, are faced with the equally difficult problem of allocation of time.

Strange as it may seem, both the industry communications man and the manufacturer of equipment have the same problem when it comes to locating each other. Because equipment of this kind has been on the industrial market for a relatively short length of time, the gas industry man is often hard put to locate a suitable selection of information on available equipment. An even more difficult problem is faced by the manufacturer of equipment in the sense that he is finding it exceedingly difficult to interpret the sprawling gas industry and to locate those with whom he can discuss his process.

There is no doubt but that the gas industry needs the facilities of a well designed telemetric and remote control system. For this reason it would behoove industry personnel and the designer of equipment to speed their efforts to find a common meeting ground.

The first major application of a telemetric system using analogue-to-digital techinques on a gas transmission line was put into operation on the newly built Gulf Interstate Gas pipeline from the Gulf coast area to the Ohio river south of Charleston, W. Va. (See October 1954 *GAS*, p. 140).

In the Gulf Interstate design it was decided to convert analogue data such as static and differential pressures, temperature and compressor engine speed into a form suitable for measurement, to measure these quantities, and finally to translate the measurements into a suitable code for tranmission on an ordinary teletype circuit.

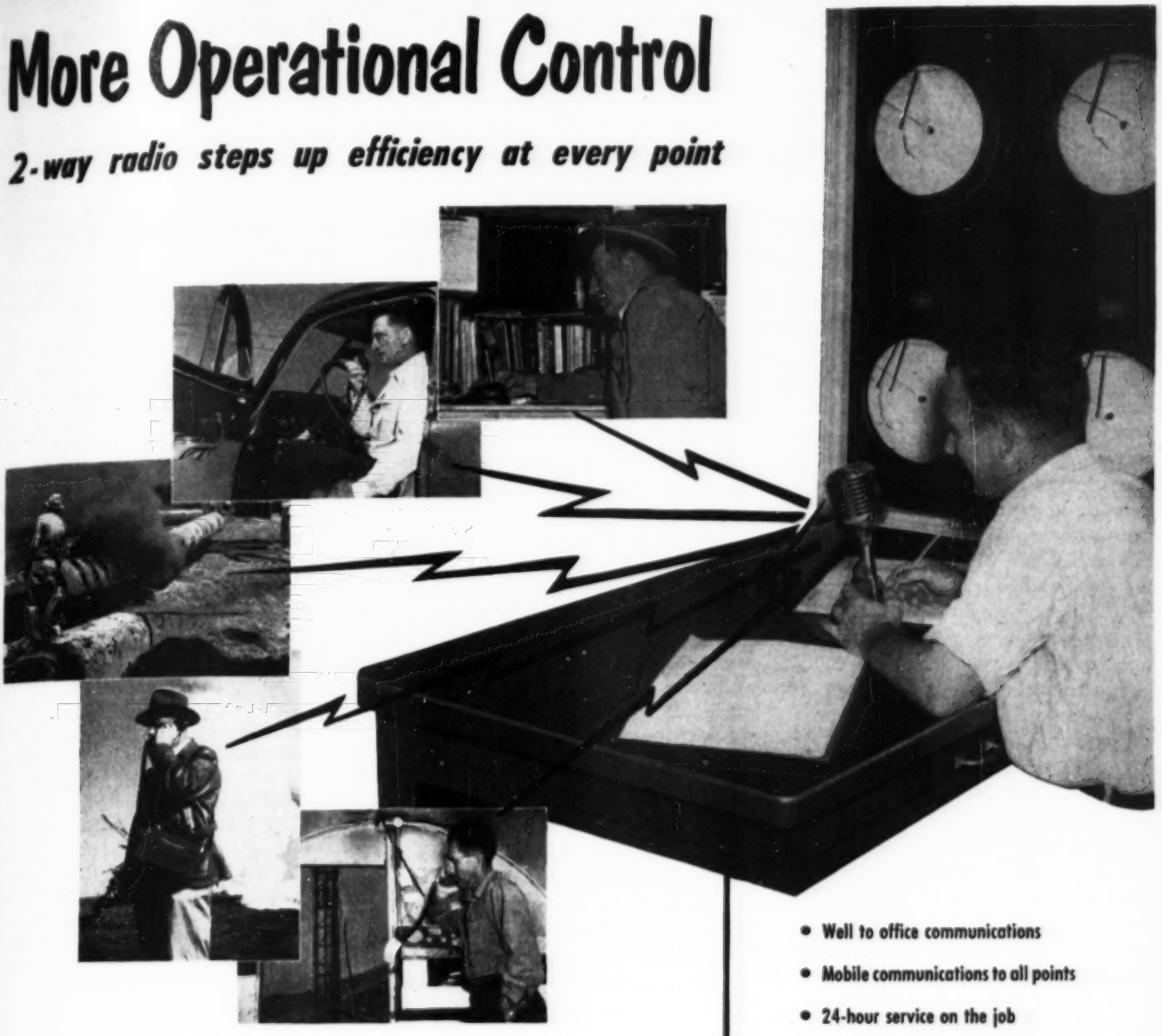
In the design of this system Berkeley division of Beckman Instruments Inc. applied the analogue output of pressure, speed and temperature transducers directly to a decimal counting unit that produced a digital display. For the transmission of this digital information to a remote point, Berkeley engineers designed special data converter units that converted the digital data into the proper Baudot code to actuate a standard teletype circuit.

Both temperature and pressure transducers used in this system develop an output frequency that varies with temperature or pressure, as the case may be. Operating frequencies from 1500 to 27,000 CPS may be obtained. However, resolution is a function of band width. For example, a 0- to 10-psi unit with a 1000-cycle band width could be read in increments of 1 part in 1000 and would change 10 cycles for each pound, giving a resolution of 0.1 psi.

The speed transducer also develops an output frequency that is a function of engine speed. This device consists of a toothed gear mounted on the shaft of the prime mover. A magnetic sensing pickup is located adjacent to the gear in such a manner that voltage will be induced in the pickup as the gear teeth pass it. An output frequency is generated that corresponds to the shaft speed.

More Operational Control

2-way radio steps up efficiency at every point



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Motorola 2-way radio is helping rack up new profits for hundreds of petroleum and gas operations around the clock. Motorola will furnish the equipment you *need* on the terms you *want* — cash purchase, installment plan, lease (with or without equity) . . . with optional installation and maintenance all included in a single contract.

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In both instances the output of the transducer is applied to an elapsed-time decade counter. This unit counts the number of events that have occurred during a given time interval and displays the digital output. The data converter is used to convert this digital output into form for transmission to a remote point.

A somewhat different approach is taken by the Pacific division of Bendix Aviation Corp. in its Electro-Span system. The Electro-Span system uses a gauge equipped with a coded disk, which converts the measured value into an electrical binary signal for transmission to a remote location. This system is based on the theory that accuracy of the primary measuring device should be retained. The digital pressure gauge is a standard dial type with a code disk attached to its output shaft. The disk-reading device consists of a set of brushes which contact the disk. To eliminate friction on the gauge shaft the brushes are held out of contact with the disk until a reading is to be taken.

Output of the system is in the form of a combination of tone signals representing a binary number. The various tones that make up the group are present or absent according to whether the brush representing each of them is in contact with a conducting segment on the coded disk. The tone oscillators are designed to operate in the audio range.

At the receiving location the complete tone signal is applied to a group of band pass filters tuned to each of the tone oscillator frequencies. Each filter is followed by a relay which will be caused to operate with the presence of the signal to which the filter is tuned. The relay contact are connected to decoding circuits, which convert the binary numbers into useful signals that are displayed on a dial indicator or lamp register.

In transmitting and receiving all the digits of one binary number simultaneously this system differs fundamentally from other methods of digital data transmission where the individual digits of each number are transmitted sequentially. For this reason, and because the digits are identifiable because of their characteristic frequencies rather than by their time relationships, the system is classified as a frequency code method of data transmission, setting it apart from the pulse code systems.

This system readily lends itself to the normal communications facilities because the binary tone signal, which is in the form of an audible "chord," may be transmitted any distance over a normal talking circuit. Also it may be readily applied to indicate any shaft rotation including those associated with remote control.

A similar coded disk is also used by Giannini Laboratory Apparatus division of G. M. Giannini & Co. to convert shaft position into digital information. However, the brushes on this device close relay contacts when they come into contact with conducting segments of the disk. These relays are contained in a translator unit which provides the decimal digit data. Readout from the unit is into either a printer device or a card punch system.

The device is particularly well adapted to the self balancing potentiometer instruments such as those manufactured by Minneapolis-Honeywell, Bristol, and Leeds & Northrup for the measurement of pressure, temperature and flow. The coded disk commutator is mounted directly on the potentiometer shaft.

For transmission purposes it would be necessary to convert the digital data into a form similar to that used in the Gulf Interstate Gas pipeline design for application to a teletype circuit.

It is of considerable importance to the gas industry communications engineer that there have been developed a wide variety of systems for the conversion of analogue information into digital form. Although the selection between them may be a difficult and time-consuming task because of the variety, he does have a greater chance of finding equipment that will best suit his own particular needs. His first task, however, should be a thorough and detailed analysis of all the types of systems that he can find available.

FCC grants failure alarm

A recent application for a VHF alarm system in the 40-50 mc. band has been granted by the FCC. The application called for VHF base stations located at points around a gas gathering field, operated normally from these points to communicate with other base and mobile units in the area. A plant failure, occurring at a time when the plant is unmanned, would trigger the VHF transmitter with a selective calling tone device for a time interval of one to three minutes.

The applicant's problem was that this sort of operation is not expressly provided for in the commission's rules. His application, however, was granted on the strength of the fact that there was a need for the type of service requested.

FCC completes survey

The Federal Communications Commission has announced the completion of its survey of land-mobile radio services which began in April 1954 to obtain certain data concerning land mobile operations in most of the Safety and Special Radio services.

In the Petroleum Radio service, which was included in the survey, 468 licensees received questionnaires. Responses were received from 337 representing a total of 72%. A total of 24,008 transmitters are authorized for this service.

Recent FCC allocations

Central Kentucky Natural Gas Co. for one base station at Mt. Olivet, Ky., on 33.38 mc.

El Paso Natural Gas Co. for one relay station at Kingman, Ariz., on 72.70 mc. and one control unit at Topock, Ariz., on 75.62 mc.

Southern Natural Gas Co. for two operational fixed units at Logansport, La., on 956.1 mc. and at Mansfield, La., on 959.7 mc.

United Fuel Gas Co. for one base station at Ceredo, W. Va., on 33.38 mc.

Mississippi River Fuel Corp. for five base stations at Zion, St. Geneviere, Pevely, Avon and Crystal City, Mo., on 48.82 mc., with one control station at Crystal City on 456.45 mc. and one relay station at Avon on 451.45 mc.

Oklahoma Natural Gas Co. for one base station at Winnia, Texas, and 20 mobile units on 30.70 mc.

United Gas Pipe Line Co. for one base station at Katy, Texas, on 48.78 mc.

Tennessee Gas Transmission Co. for four base stations at Victoria and Jasper, Texas; Monroe, La., and Greenville, Miss., on 33.26 mc.

United Fuel Gas Co. for one base station at Ripley, W. Va., on 33.38 mc.

Southern Natural Gas Co. for one base station at Selma, Ala., on 49.06 mc.

Transcontinental Gas Pipe Line Corp. for 36 operational fixed units, three near Myrtlewood, Summerfield, Roanoke and Rockford, Ala.; Vossburg, Miss. and Carrollton, Ga.; on 1905 mc. near Jackson Gap, Billingsley and Uniontown, Ala.; Stockbridge and Franklin, Ga. and Quitman, Miss. on 1855 mc.

El Paso Natural Gas Co. for one base station at Midkiff, Texas, on 48.74 mc.

Gulf Interstate Gas Co. for one base station at Houma, La., on 48.72 mc.

Olin Gas Transmission Corp., for one base station at Community, La., on 48.58 mc.

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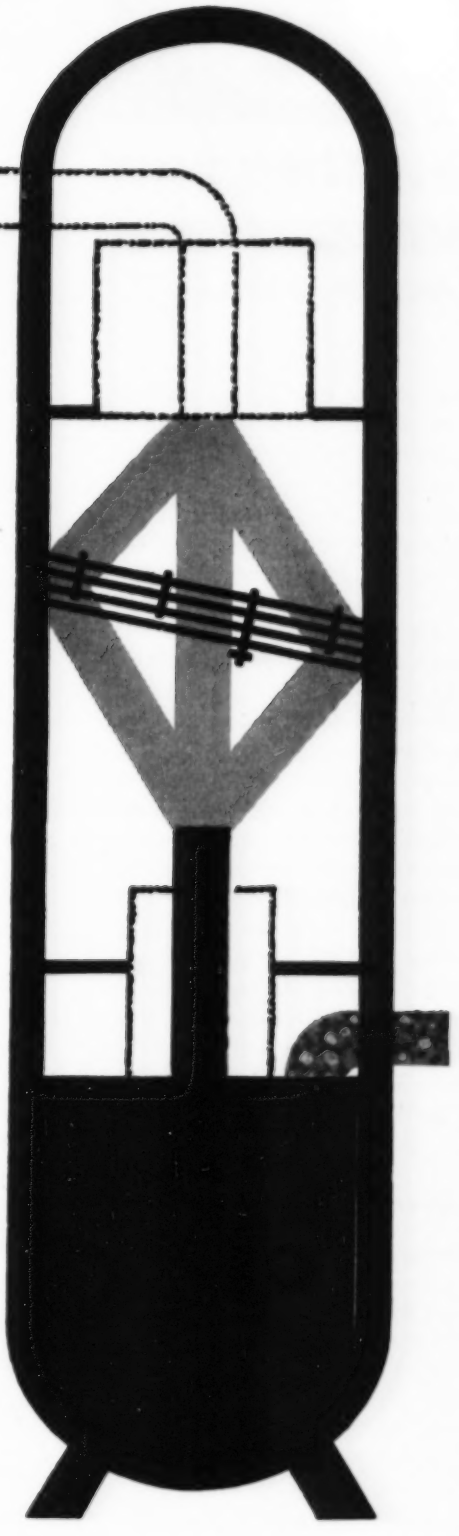

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WASHINGTON

Utilities may have to help pay for $101 billion highway program

By LARSTON FARRAR

ONE problem that is plaguing both the natural gas industy and utilities generally, as well as many conscientious members of Congress these days, relates to that of the $101 billion highway program, which President Dwight D. Eisenhower has dumped into Congress' lap.

The nub of the problem, from the standpoint of the entire utility industry, is the question as to whether Uncle Sam, who is whooping it up for the super-highway program, should not have to pay all, or a large share, of the costs involved in relocating pipeline, telephone poles, electric power lines, etc., that must be moved whenever a super-highway is built.

The problem is red-hot right now because the $101 billion highway program (which would take place over the next decade) conceivably could cost the utility industry, as a whole, some $4 billion, more or less, and that's no inconsequential sum even in Washington.

Realization

Virtually every utility group in the country, from the Independent Natural Gas Association to the American Gas Association, and many others in the telephone, electric (public and private) and even water utilities field, realize that when this $101 billion worth of super-highways are put down, it will necessitate the relocation of an incalculable number of gas pipelines, utility poles (telephone and telegraph and electric) and other utilities installations.

A summary of questionnaires sent to utilities in all parts of the country has shown that the cost of relocating utilities, because of highway construction financed in part by federal aid, has been averaging about 4.1% for the nation as a whole. There are wide variations in the costs entailed by various utilities, and such relocation costs depend to a large extent on the states involved. For instance, the average relocation cost in Nevada (a very sparsely populated state) runs only 0.35%. That is, about one-third of 1%. However, in Connecticut, a densely populated state the cost runs 12.5%, while in Maryland the average was 24.06%, and in Massachusetts 14.03%. These are percentages of the total amount of highway construction in which federal aid was involved.

The utility industry right now is on figurative pins and needles because Congress last year ordered the U. S. Department of Commerce to make a study to determine what, if anything, Uncle Sam should do about this problem. Congress, it is recalled, deleted a provision from the road bill last year that would have had a Congressional committee undertake the study, and, instead, sent the problem to the desk of Secretary of Commerce Sinclair Weeks, who promply turned it over to his Bureau of Public Roads, which began making studies. The utilities industry, as a unit, including public and private sectors, cooperated to the fullest extent in trying to find out just how great their burden would be in the future, by making the questionnaire survey mentioned above to get an idea of just how great the burden has been.

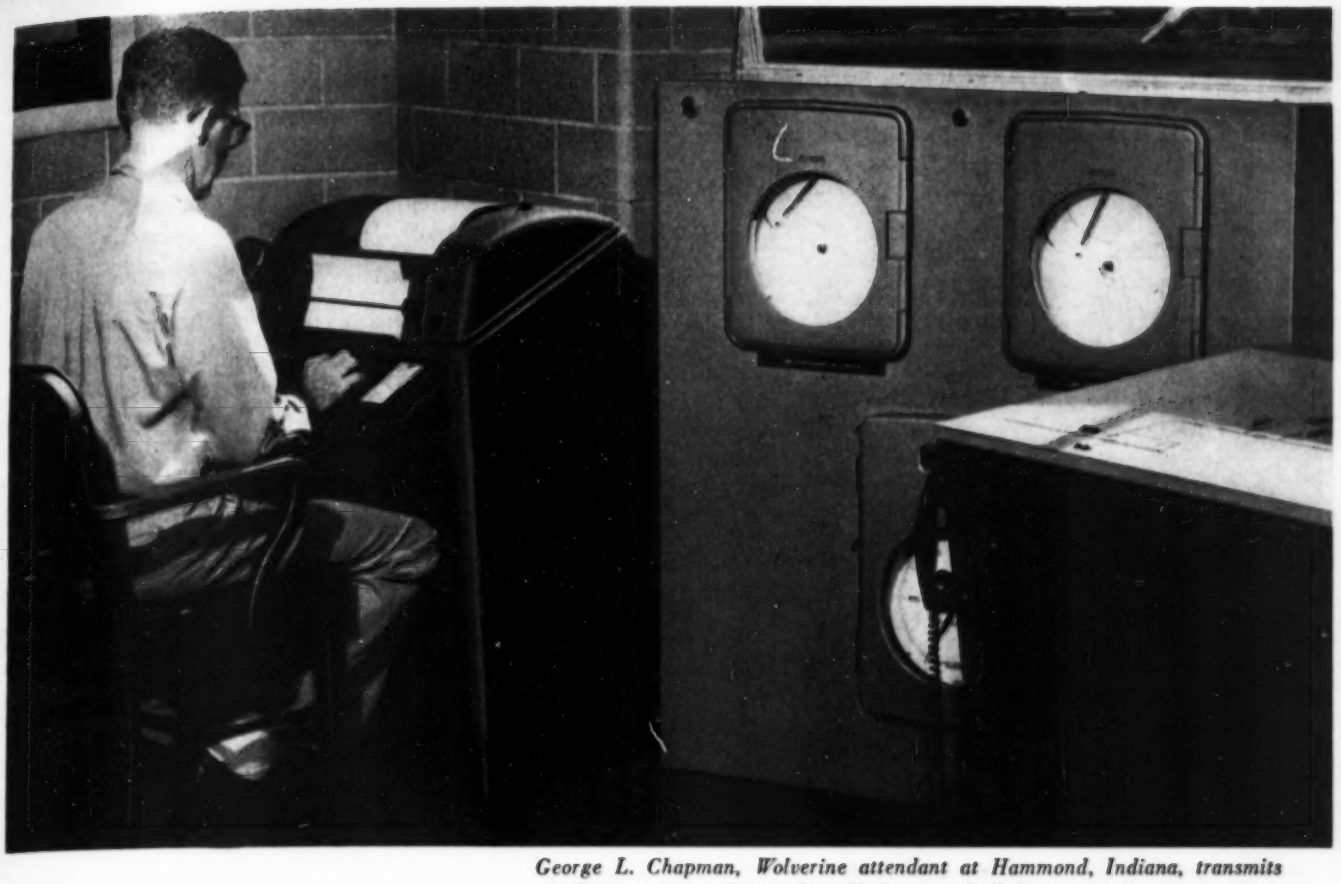
Overdue

The report actually was due on Capitol Hill on Feb. 1, but the results of the study of the public roads commissioner were just handed to Secretary Weeks at that time. He sent a request to Congress for an additional six weeks or two months in which to ponder the questions inherent in the problem before making his recommendations. These recommendations from the Secretary of Commerce are expected to be sent to Capitol Hill around April 1, barring other delays, which is why the gas industry, as well as the utility industry generally, figuratively is holding its breath.

While Mr. Weeks' recommendations are not, of course, to be considered as the last word on the subject, what he says may have an important bearing on what Congress will do. The utilities generally have been getting their message over to Congressmen, some of whom are very sympathetic, so if there is action on the President's road program this year—a big question mark in itself—there may be action also on the idea of writing in a provision to reemburse utilities for relocation expenses.

Inaccurate estimate

Actually, no one can estimate, with any degree of accuracy, just how much money the relocating of lines—inside or outside of urban areas—would cost utilities, because the extent of the highway program Congress will adopt not yet is known. Also, much depends on the location of the proposed superhighways, the construction time-table, and other factors. The American Gas Association has pictures showing how Chicago razed a lane that was one city block square for many miles right through its downtown area. The cost of relocating the utilities, in clearing this super-highway area, undoubtedly ran into the millions of dollars just for a few miles. On the other hand, a superhighway could be built for hundreds of miles in many areas and the total relocation cost to utilities might be an infinitesimal percentage of the overall cost. The gas industry knows, however, that unless Uncle Sam will arrange to reimburse all, or a goodly part, of the



George L. Chapman, Wolverine attendant at Hammond, Indiana, transmits pipeline operations data to New York over a Bell System teletypewriter circuit

"Bell System furnishes us dependable communications at a price we can't equal"

—says Cyrus S. Gentry, President of the Wolverine Pipe Line Co.

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From Hammond, Indiana, products are started along the 295 miles of 16-inch pipe line to Detroit and Toledo. By using a Bell System teletypewriter circuit the operator starts or stops the big high-pressure pump at Vicksburg, 125 miles away.

Hundreds of miles east in New York, a dispatcher keeps round-the-clock watch over the Wolverine Pipe Line's seven stations. He gets reports and sends orders over Bell System teletypewriters.

"The expense of a privately owned system would be far in excess of a rented circuit," says a Wolverine official.

To find out how your communications efficiency could be improved, and costs lowered by using Bell System service, ask your Bell Telephone representative.

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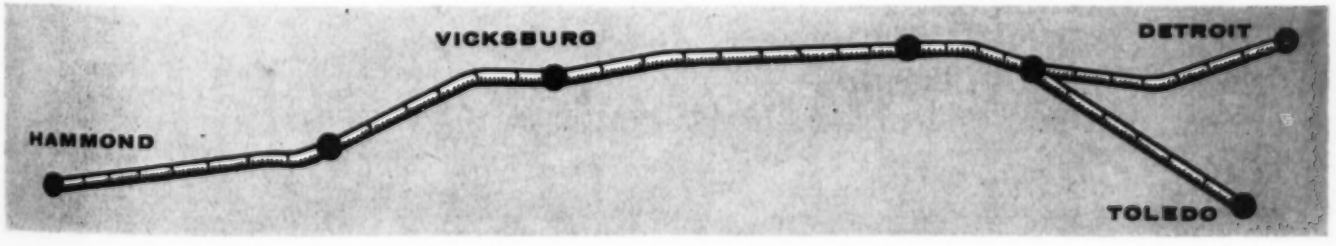

cost, the industry as a whole will have to pay out hundreds of millions of dollars, in the next decade.

Historically, Uncle Sam has reimbursed the railroads for virtually all the costs involved in grading for underpasses or overpasses This was considered the fair and just thing to do, and other utilities, until recent years, have not been affected to a great extent by highway construction.

Now, however, the tremendous amount of super-highway construction —and particularly the projects that are planned—makes a vital difference. Whereas relocation once was only a minor problem, it may become a major one—and very likely *will*—with gas pipelines and other gas companies in and near major urban areas.

Unusual angles

There are some unusual angles to the problem, as it has unfolded.

It has shown, for instance, that there is a well-organized lobby against the utilities on this issue. This lobby consists in the main of the American Automobile Association, which has the willing assistance of the so-called "tourist Congressmen," such as Sen. George Smathers (D.-Fla.), and, it is said, the legislators from Florida and California and other states who depend on a large tourist influx for a lot of business. These legistators are said to stand vigorously against giving utilities one dime for relocation purposes, since this dime—or a few more dimes—could be used to help build some more super-highways.

Another angle to the controvery is that the publicly owned utilities in many cities and states have stood solidly with the privately owned utilities on this issue. Dixon-Yates and the TVA, so to speak, stand side by side in believing that Uncle Sam should reimburse utilities for all, or a large share of, the relocation costs involved in new highway construction in which federal funds are involved.

Support

Another angle to the controversy that is unusual is that some Congressmen from the states that would seem to gain the most from highway construction may be the ones who will stand most firmly behind a fair deal for utilities that are involved in the plans and will want to be reimbursed for relocation costs. Many of the "liberals" who otherwise might be opposed to utilities may be found to be on the side of the utilities in this fight, since many of the utilities involved will be publicly owned and operated.

While no specific bill, as yet, has been introduced in Congress this year to provide for relocation reimbursement to utilities, such legislation almost inevitably will be introduced after Secretary Weeks has made his report, or will be appended, to the highway program, if the program comes up for floor action. The utility spokesmen do not expect swift action, but they are hopeful that a quiet campaign of education will convince the legislators that reimbursement for relocation costs is the only fair and just thing for Congress to do.

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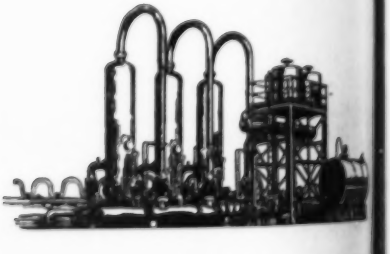

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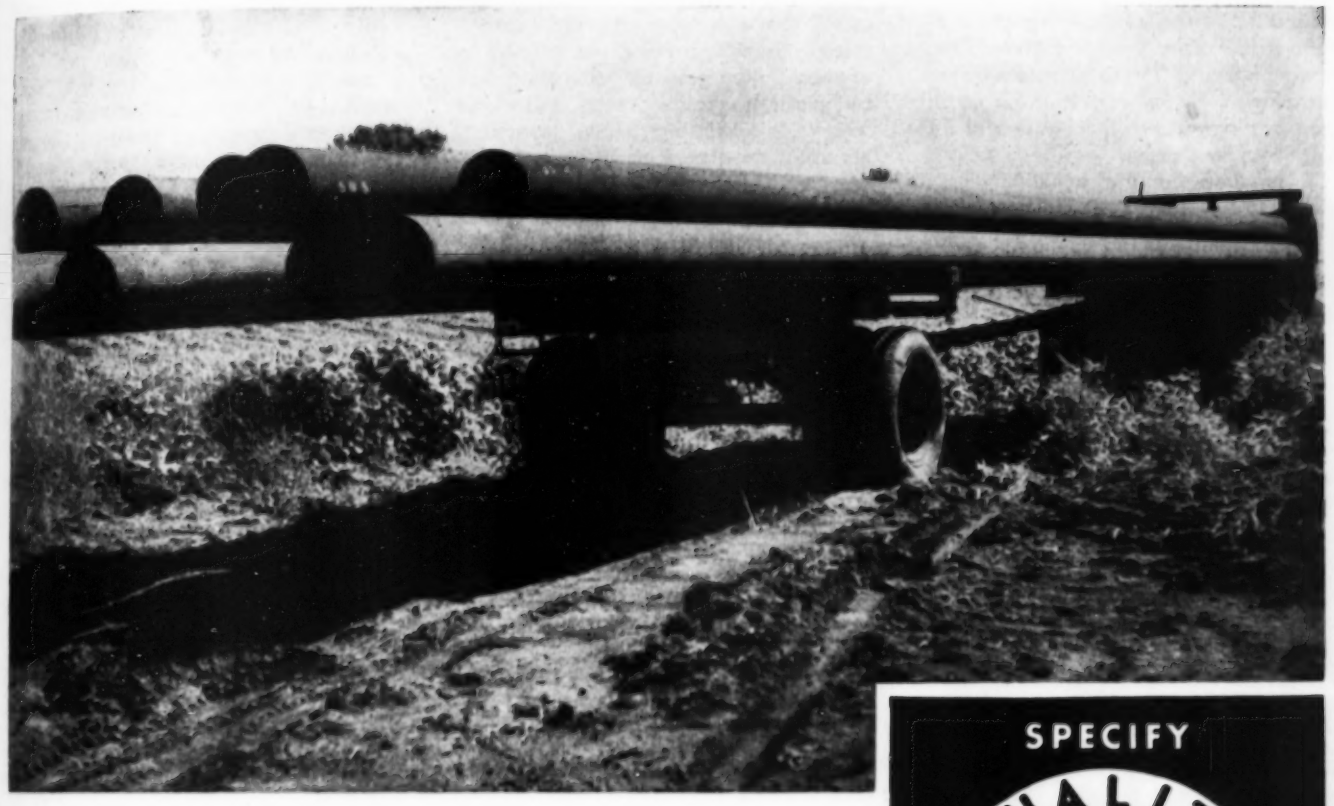

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GAS pipeline news

Proved reserve estimates at 263 billion ft, down from previous years

PROVED natural gas reserves in the United States on Dec. 31, 1954, reached a new high of 211.7 trillion cu ft, the joint report of the Committee on Reserves of the AGA and API has revealed.

The most significant fact in this report, however, is not the record—for every year in the nine years that the reports have been issued has seen a new record established—but the relative magnitude of the increase over the previous year's estimates. Only 263 billion ft were added to 1953's proved reserves estimates, a figure that contrasts with increases ranging from 5 to almost 13 trillion in past years.

Production, up almost 200 billion over 1953, totaled 9,426,509 MMcf, while discoveries combined with extensions and revisions totaled 9,599,203 MMcf. A year earlier, these combined categories had totaled more than 20 trillion.

Discoveries of new fields and new pools in old fields were better than average—4,966,894 MMcf, 2 trillion short of 1953's record, and a half-trillion short of the 1952 figure, but well ahead of any previous year. However, the single category "extensions and revisions" made a relatively poor showing, indicating that a number of earlier discoveries were not proving out as well as expected. The gain of 4.6 trillion was by far the smallest recorded in any year since the committee began reporting; six states actually reported losses in this category. This was the second straight year in which one or more states wound up in the "red," four having so reported last year.

These losses were more than offset, however, by the excellent record established by Louisiana, where offshore reserves helped bring the total of extensions and revisions to 2,595,319. New discoveries in the state reached a total of 1,252,836, which when added to the former figure gave the state a healthy margin in net-increase-over-production of well in excess of 2 trillion ft.

Texas, with its offshore reserves included, also racked up sizeable increases in both categories, but with production running 4,763,415, a net loss in reserves of 1.4 trillion was shown. A year earlier, Texas' net gain had been in the neighborhood of ¾ of a trillion ft.

Most disappointing of the reports were those from Utah, where earlier estimates proved to be considerably overoptimistic. In the "extensions and revisions" column, Utah dropped 717 billion, bringing its net reserves at year's end to 387 billion. A year earlier, the estimate had been 1.1 trillion.

Arkansas, Colorado, Montana, New Mexico, and Wyoming were also in the red on extensions and revisions. All but Colorado and Wyoming were also off in net production. New Mexico's drop was fairly sizeable.

Others showing a net reserves decrease were California (for the sixth

ESTIMATED PROVED RECOVERABLE RESERVES OF NATURAL GAS IN THE UNITED STATES
(Millions of Cubic Feet—14.65 Psia at 60° F)

	Changes in Reserves During 1954					Reserves[2] as of Dec. 31, 1954				
	Reserves as of Dec. 31, 1953[2] (1)	Extensions and Revisions[2] (2)	Discoveries of New Fields and New Pools in Old Fields[2] (3)	Net Change in Underground Storage[3] (4)	Net Production[4] (5)	Total (Columns 7 + 8 + 9 + 10, also Columns 1 + 2 + 3 + 4 less Column 5) (6)	Non-Associated[5] (7)	Associated[6] (8)	Dissolved[7] (9)	Underground Storage[8] (10)
Arkansas	1,211,266	(-)19,422	3,872	1,689	32,026	1,165,379	517,112	361,927	279,437	6,903
California[9]	9,159,347	287,939	59,110	(-)11,255	468,538	9,026,603	2,270,399	2,120,603	4,583,222	52,379
Colorado	1,864,275	(-)149,945	174,374	0	55,791	1,932,913	1,173,662	57,097	702,154	0
Illinois	231,251	33,206	4,048	19,802	34,551	253,756	2,500	9,863	221,591	19,802
Indiana	35,830	7,258	285	(-)1,274	6,050	36,049	2,350	2,802	25,433	5,464
Kansas	15,787,602	179,140	233,601	10,768	452,779	15,758,332	15,149,660	214,253	342,457	51,962
Kentucky	1,301,533	44,815	10,340	1,919	72,000	1,286,607	1,208,155	0	57,133	21,319
Louisiana[9]	34,458,912	2,595,319	1,252,836	0	1,507,081	36,799,986	29,276,768	4,939,363	2,583,855	0
Michigan	275,519	37,163	7,961	19,093	9,636	330,100	31,194	20,000	65,703	213,208
Mississippi	2,569,181	361,267	8,750	159	166,674	2,772,683	2,029,557	478,232	264,082	812
Montana	764,000	(-)31,127	22,674	1,179	32,995	723,731	576,628	33,262	83,555	30,286
Nebraska	182,110	6,742	17,009	0	12,915	192,946	112,003	13,960	66,983	0
New Mexico	17,522,210	(-)331,033	549,760	(-)26,636	473,632	17,240,669	13,703,708	1,720,055	1,745,829	71,077
New York	71,004	298	0	1,913	3,853	69,362	38,962	0	403	29,997
Ohio	755,982	27,859	8,780	13,651	31,531	774,741	506,483	0	29,723	238,535
Oklahoma	12,228,373	771,691	247,151	6,914	857,981	12,396,148	6,563,227	2,014,666	3,736,573	81,682
Pennsylvania	751,844	72,034	21,325	45,010	158,050	732,163	439,503	0	34,728	257,932
Texas[9]	106,529,626	1,278,190	2,078,659	6,002	4,763,415	105,129,062	68,536,351	20,856,529	15,722,881	13,301
Utah	1,113,058	(-)716,993	7,733	0	16,423	387,375	384,543	0	2,832	0
West Virginia	1,653,942	100,743	22,000	104	169,499	1,607,290	1,384,056	0	57,116	166,118
Wyoming	2,739,631	(-)27,018	229,019	1,868	88,429	2,855,071	2,095,562	153,495	586,158	19,856
Miscellaneous[1]	240,636	4,183	7,607	0	12,660	239,766	73,686	0	166,080	0
TOTAL	211,447,132	4,632,309	4,966,894	90,906	9,426,509	211,710,732	146,076,069	32,996,107	31,357,928	1,280,620

1 Includes Alabama, Arizona, Florida, Maryland, Missouri, North Dakota, and Virginia.
2 Excludes gas loss due to natural gas liquids recovery.
3 The net difference between gas stored in and gas withdrawn from underground storage reservoirs, inclusive of adjustments and native gas transferred from other reserve categories.
4 Net production equals gross withdrawals less gas injected into producing reservoirs. Changes in underground storage and gas loss due to natural gas liquids recovery are excluded. Fourth quarter production estimated in some instances.
5 Non-associated gas is free gas not in contact with crude oil in the reservoirs.
6 Associated gas is free gas in contact with crude oil in the reservoirs.
7 Dissolved gas is gas in solution with crude oil in the reservoirs.
8 Gas held in underground reservoirs (including native and net injected gas) for storage purposes.
9 Includes off-shore reserves.

SUMMARY OF ANNUAL ESTIMATES OF NATURAL GAS RESERVES FOR PERIOD DEC. 31, 1945 TO DEC. 31, 1954
(Millions of Cubic Feet—14.65 Usia at 60° F)

Year	Extensions and Revisions	Discoveries of New Fields and New Pools in Old Fields	Total of Discoveries, Revisions and Extensions	Net Change in Storage	Net Production During Year	Estimated Proved Reserve as of End of Year	Increase Over Previous Year
1945	—	—	—	—	—	147,789,367	—
1946	(0)	(0)	17,729,152	(0)	4,942,617	160,575,901	12,786,535
1947	7,570,654	3,410,170	10,980,824	(0)	5,629,811	165,926,914	5,351,013
1948	9,769,483	4,129,089	13,898,572	51,482	6,007,628	173,869,340	7,942,426
1949	8,061,429	4,612,870	12,674,299	82,746	6,245,041	180,381,344	6,512,004
1950	9,172,381	2,877,351	12,049,732	54,301	6,892,678	185,592,699	5,211,355
1951	13,013,606	3,039,385	16,052,991	132,751	7,966,941	193,811,500	8,218,801
1952	8,934,470	5,411,043	14,345,513	198,850	8,639,638	199,716,225	5,904,725
1953	13,371,355	7,081,661	20,453,016	516,431[1]	9,238,540	211,447,132	11,730,907
1954	4,632,309	4,966,894	9,599,203	90,906	9,426,509	211,710,732	263,600

(0) Not estimated.
1. All native gas in storage reservoirs formerly classified as a natural gas reserve is included in this figure.

straight year), Kansas, Kentucky, New York, and West Virginia.

Natural gas liquids showed a slight loss, from 5.4 billion barrels to 5.2 billion. Production, however, was also down—from 303 million to 301 million barrels. This was the first year that a dip was noted in either category.

Crude oil reserves showed up well, increasing from 28.9 billion barrels to 29.6 billion, another new record. Added to natural gas liquids, these reserves gave a total of liquid hydrocarbon reserves of 34.80 billion barrels, compared with 34.38 in 1953.

FPC denies dismissal motions in import case

Motions to dismiss applications by Northern Natural Gas Co., Omaha, requesting authority to import natural gas from Canada to serve markets in the midwestern United States have been denied by the FPC (Docket G-2063).

The motions to dismiss were filed by eight of Northern's utility customers, and were joined in by coal, labor and railroad interveners. The latter interveners also sought to have related applications by Northern, involving the construction of other pipeline facilities in the United States, dismissed.

The FPC said that the motions involve a final determination of the proceedings. The commission pointed out that during hearings held in January Northern concluded its presentation of evidence, but that its witnesses have not been subject to cross-examination and that further evidence will be adduced which may affect a determination of the issues. Northern is proposing to construct new pipeline facilities to enable it to purchase natural gas from Trans-Canada Pipe Lines Ltd. at Emerson, Manitoba.

The motions to dismiss were based among other things, on the contention that Northern had failed to make a showing with respect to the feasibility of the proposed Trans-Canada pipeline project.

* * *

Northern Natural has published a booklet entitled "Natural Gas . . . What the Consumer Should Know About the Nation's Gas Supply," by Ralph E. Davis, gas and oil consultant, to sway public opinion in favor of its plans to import gas from Canada. The booklet is being distributed to Northern's customers in the Northern Plains area.

In his announcement of the booklet, John F. Merriam, president of Northern, says that "there is some opposition (to importing Canadian gas) because this gas will be slightly higher in price. Because the results of this controversy may have a strong effect on the economics of the area in which you live, we believe you will be interested in the . . . booklet on natural gas reserves.

"I believe that after reading this booklet, you will conclude that it is worth paying a slightly higher price . . . to have the assurance that there will be an adequate supply for many years to come."

Bill in Texas legislature may curb FPC jurisdiction

If enacted by the Texas Legislature, an "economic waste" bill backed by the Texas Independent Producers & Royalty Owners Asssociation should block further expansion of FPC controls over natural gas production and might overrule some of the steps already taken in that direction, according to an article in *The Oil Daily*.

The prediction was made by Jack Woodward of Dallas, TIPRO president, in which he describes the new measure as "perhaps Texas' most vital bill since it passed its oil and gas conservation laws in the 1930's." It would provide for Texas Railroad Commission hearings to determine the value of gas from any well, field or area of a field, giving the commission authority to shut in wells where necessary to prevent waste. Twin goals, the TIPRO president said, are (1) to place railroad commission authority between gas production and either the FPC or "monopolistic pipeline company management," and (2) eventually to prorate gas like oil, "so that each well will share the total gas market at a fair and reasonable field price."

He said he thought the FPC would recognize Texas' right to prevent "economic waste" because it has not interfered with other state conservation measures, including price fixing laws in Oklahoma and Kansas. However, he emphasized that the Texas bill does not attempt to fix prices, as critics are saying, but in reality is an "anti-price fixing measure."

Transco to boost daily capacity to 695 MMcf

Tom P. Walker, president of Transcontinental Gas Pipe Line Corp,, Houston, has announced that the company will proceed immediately with an $83 million construction program, as a result of the latest Federal Power Commission order approving its plan for expansion (Dockets G-4185 and 2367).

The certificate just granted, coupled with FPC approval of an earlier application, will enable Transcontinental to boost its daily allocated capacity from 565 to 695 MMcf of natural gas and its peak day allocated capacity to 831 MMcf, including deliveries from storage.

The expansion program will involve 23 separate construction projects in 11 states along the line from Texas to New York. Work on all of these will pro-

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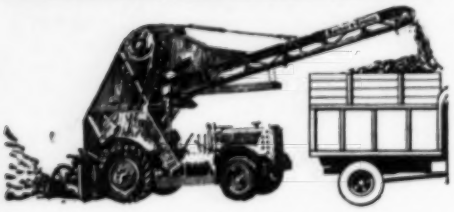

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ceed simultaneously, with completion scheduled for the 1955-56 heating season.

Forty-eight public utility, industrial and municipal customers of Transcontinental will receive increases in their allocations when the expanded facilities are placed in operation. Altogether they will receive an additional 130 MMcf of daily allocated capacity.

In the New York area, the daily allocation to Consolidated Edison Co. will be increased from 138 to 144 MMcf; Brooklyn Union Gas Co. from 80 to 85 MMcf; Brooklyn Borough Gas Co. from 9 to 10 MMcf; and Kings County Lighting Co. from 9 to 9.5 MMcf.

In New Jersey, daily allocations to Public Service Electric & Gas Co. will be increased from 74 to 99 MMcf; Elizabethtown Consolidated Gas Co. from 16 to 21 MMcf; and South Jersey Gas Co. from 21 to 30 MMcf.

In Philadelphia daily allocations to United Gas Improvement Co. will be increased from 26 to 41 MMcf.

South the Potomac, the largest increases will go to Piedmont Natural Gas Co., where daily allocations will be stepped up from 23 to 35 MMcf, and Public Service Co. of North Carolina from 16 to 25 MMcf. Many other customers in the southern states along the line will receive increased supplies of gas in varying amounts.

Major construction projects to be carried out this year include the laying of 315 miles of 36-in. pipe, 219 miles of 30-in. pipe, and 46 miles of smaller diameter pipe; additional crossings of the Potomac and Savannah rivers; and the building of two new compressor stations—one in Texas and one in Louisiana. Approximately 45% of the company's transmission line will have been looped from the gas producing area to New York City when this year's construction projects are completed.

Noteworthy were Transcontinental plans to lay the 315 miles of 36-in. diameter pipe. Last year Transco pioneered use of this giant pipe by laying 47 miles of it in Mississippi and Alabama. Transco engineers have found that super-inch pipe will transport 60% more gas than a 30-in. line and almost three times as much as a 24-in. line.

Request for injunction to restrain FPC denied

Judge Kirkland of the District Court for the District of Columbia has denied the request of Gulf Oil Corp. and Gulf Refining Co. for a temporary injunction to restrain the enforcement of Federal Power Commission Order 174-B and the Natural Gas Act.

The court ruled from the bench that the injunction would not be granted because plaintiffs had failed to show that there was irreparable injury and because plaintiffs had not exhausted their administrative remedy. The court noted that the precise question involved in this case is now being tried before the FPC in the Deep South case.

FPC General Counsel Gatchell commented after the court had acted that this Gulf case raised the identical points involved in the Union Producing Co. case, where Judge Holtzoff of the same court granted Union a preliminary injunction late in December.

Texas Gas would build 207-mile additions

Owensboro, Ky., is seeking authority for the construction of about 207 miles of pipelines and 22,600 hp in compressor capacity on its transmission system in Louisiana, Mississippi, Tennessee, Kentucky, and Indiana (FPC Docket G-6854).

The new facilities would be used to increase firm deliveries to Ohio Fuel Gas Co., Columbus, by 39,650,000 cu ft per day; to serve the entire estimated requirements of the Horseshoe system of Indiana Gas & Water Co., Indianap-

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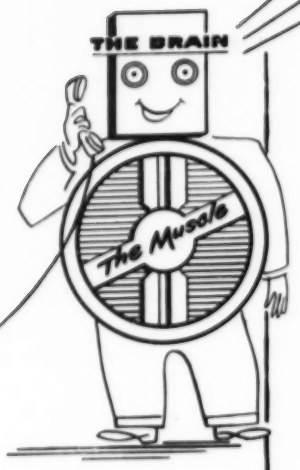

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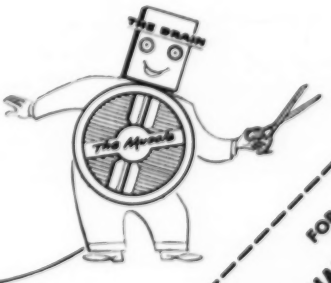

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olis, through a proposed new lateral; and to serve the increased firm requirements for the 1955-56 winter of present customers, other than Ohio Fuel, in the amount of 50,833,000 cu ft per day.

Approximately 90 miles of the proposed new pipeline would parallel sections of Texas Gas' existing system. The remainder of the new pipeline would constitute the new lateral to serve Indiana Gas, an existing customer.

Tennessee Gas directed to serve two New York firms

Tennessee Gas Transmission Co., Houston, has been directed by the FPC to supply natural gas to Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y., and Rockland Light & Power Co., Nyack, N. Y. (Dockets G-2331 and G-2419).

The two New York companies had intervened in proceedings on an application by Tennessee to construct new facilities to expand its pipeline system. The FPC by order issued Dec. 28 disposed of the Tennessee application but reserved decision on the Central Hudson and Rockland requests pending an oral argument which was held Jan. 14.

Home Gas Co., Pittsburgh, which supplies gas to the two New York utilities, also had intervened in the Tennessee proceeding, in oppostion to the requests of Central Hudson and Rockland. The commission declared that while the public interest requires service by Tennessee to Rockland and Central Hudson, it also requires a limitation on such service so that it will not have a significant offset upon Home's sales.

Tennessee was directed to sell a maximum of 5 MMcf daily and 1287 MMcf annually to Rockland during the period from Dec. 1, 1955, to Dec. 1, 1957, and not more than 7 MMcf per day or 1800 MMcf per year thereafter. Deliveries by Tennessee to Central Hudson are limited to 4.5 MMcf daily and 1100 MMcf annually through Dec. 1, 1957, and not in excess of 6.4 MMcf daily and 1600 MMcf per year thereafter.

More than $14.5 million refunded by 7 companies

Seven natural gas companies have refunded a total of $14,691,814 to their wholesale customers since the first of this year pursuant to rate conditions contained in orders issued by the FPC.

The seven companies, and the amounts refunded, are: East Tennessee Natural Gas Co., Knoxville, $297,912; Hope Natural Gas Co., Clarksburg, W. Va., $603,714; Home Gas Co., Pitts-

burgh, $1,161,975; Michigan Wisconsin Pipe Line Co., Detroit, $8,589,596; Ohio Fuel Gas Co., Columbus, $739,400; Texas Eastern Transmission Corp., Shreveport, $357,810; and Texas Illinois Natural Gas Pipeline Co., Chicago, $2,941,407.

The refunds made by Texas Eastern result from invalidation of the Texas gathering tax. These refunds are in addition to others previously made. Refunds by all the other companies are the result of settlement of rate proceeding and represent the return of excess charges for various periods.

State jurisdiction covered in report issued by FPC

A new edition of "State Commission Jurisdiction and Regulation of Electric and Gas Utilities" has been published by the FPC.

The new report, dated June 1954, presents the results of a survey of commissions in all 48 states and in territorial possessions and contains a total of 13 tables indicating the powers of state commissions to regulate electric and gas utilities, other general information on the commissions, and information on regulatory practices in the various jurisdictions, together with supporting text material.

The report shows that commissions with power to regulate one or more of the public utility industries exist in each of the 48 states, the District of Columbia, Hawaii, and Puerto Rico.

A pocket insert which accompanies the new edition shows the name and address of the various utility regulatory commissions, the names of the commissioners, and the names and titles of the principal officials.

Copies of the report may be purchased from the Publications Division, FPC, Washington 25, D. C. The price is $1.50 per copy, and the order number is FPC S-113.

Southern Natural to serve three Georgia towns

Orders have been issued by the FPC directing Southern Natural Gas Co., Birmingham, to supply natural gas to three Georgia towns, and directing the Ohio Fuel Gas Co., Columbus, to sell gas to the Forest (Ohio) Gas & Oil Co. (Dockets G-2512, et al).

The Georgia communities to receive gas from Southern Natural's system are Statesboro, Sylvania, and Woodland. Forest Gas will distribute the gas it receives from Ohio Fuel to customers

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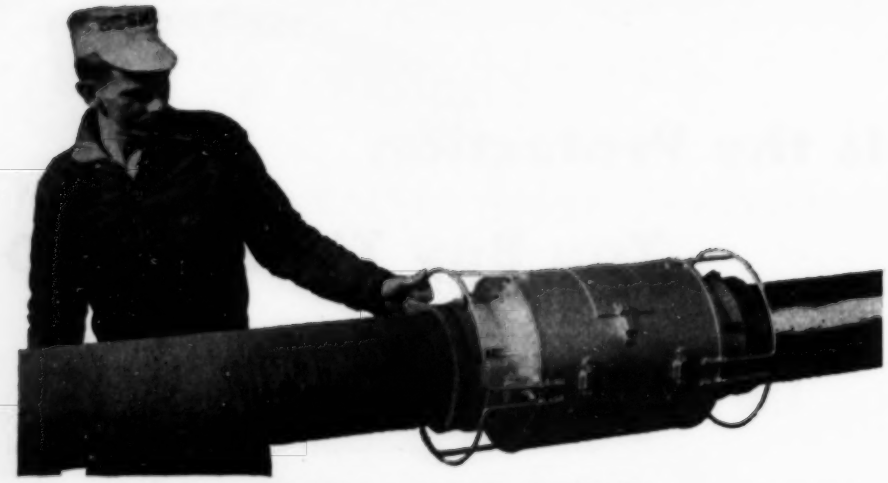

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Statesboro's initial requirements are estimated at 848 Mcf on a peak day, and 86.7 MMcf annually. Estimated cost of the facilities to be built is $775,000. Sylvania estimates its initial requirements at 258 Mcf on a peak day, and 27.7 MMcf per year. Its facilities would cost an estimated $350,000. Woodland, which will build facilities costing $48,000, estimates its initial peak day requirements at 85 Mcf, and its annual requirements at 5466 Mcf.

Forest Gas will construct facilities estimated to cost $34,123. Its initial requirements are estimated at 250 Mcf on a peak day, and 35 MMcf per year.

Commissioner Nelson Smith not up for reappointment

Nelson Lee Smith, who has been a member of the FPC since October 1943 and was its chairman from Jan. 1, 1947 to May 24, 1950, has announced that he does not wish to be considered for reappointment upon the expiration of his present term, June 22, 1955.

According to word from the White House, William R. Connole, general counsel of the Connecticut PUC, will be named to succeed him.

1954 was 'memorable,' says FPC in annual report

The fiscal year 1954 is described as a "memorable period" by the Federal Power Commission in its 34th annual report, covering the 12 months ended June 30, 1954.

One of the most important events of the fiscal period, the commission indicated, was the Supreme Court's decision in the Phillips Petroleum Co. case, which brought an estimated 5000 independent producers of natural gas under FPC regulation.

The commission reported that it disposed of 190 applications for new and additional natural gas construction as compared with 171 in the 1953 fiscal year. These involved 9339 miles of pipeline and 276,760 hp in compressor capacity—with a total estimated cost of $631,173,205. At the end of the fiscal year 1954, the FPC said, 83 certificate applications for facilities costing a total of about $374,017,607 were pending.

The commission declared that regulating the rates of interstate natural gas companies is one of its major problems despite successful efforts to speed up the handling of filings. A total of 706 rate filings were made during the fiscal year

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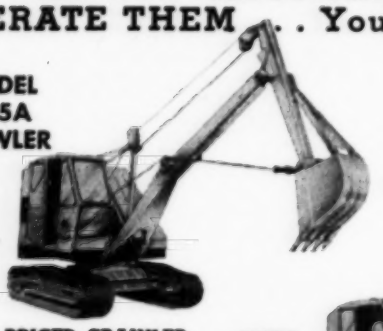

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1954 as compared with 662 in the preceding year, with increases totaling $124 million annually as against $112 million in 1953. However, due to faster handling, about $155 million in rate increase applications were disposed of, including actions on the backlog from the previous year, whereas only 549 million had been disposed of in the fiscal year 1953.

Copies of the 1954 annual report may be purchased from the Publications Division, Federal Power Commission, Washington 25, D. C., at 60 cents each. The order number is FPC A-47.

FPC issues revised map of major pipelines

The Federal Power Commission has issued a Dec. 31, 1954, revision of its map of "Major Natural Gas Pipe Lines" in the United States. The map supersedes the June 30, 1954, edition.

The map, approximately 13 by 19 in. in size, is printed in four colors on a scale of 165 miles per inch. It shows major existing pipelines, those which are under construction or have been authorized but not yet started, and proposed lines which are pending before the commission.

Each line is numbered to refer to an index of operating companies appearing at the bottom of the map. Existing or proposed pipeline system of 115 companies appear on the map. In addition to the pipelines, the map shows gas fields, indicating both the major sources and generalized areas of natural gas supply.

Copies of the map may be purchased from the Publications Division, Federal Power Commission, Washington 25, D. C., at 25 cents each. The order number is FPC M-42.

CIG budgets $35 million for 1955 construction

A construction budget of more than $35 million has been approved by the board of directors of Colorado Interstate Gas Co. for 1955.

Highlighting the proposed construction during the year is the 365-mile natural gas pipeline from Rock Springs, Wyo., to Denver. Construction of this line is contingent upon start of construction of the Pacific Northwest Pipeline Corp.'s line. The 22-in. line and allied facilities are estimated to cost approximately $24 million.

Approximately $3 million has been budgeted for drilling gas wells of both

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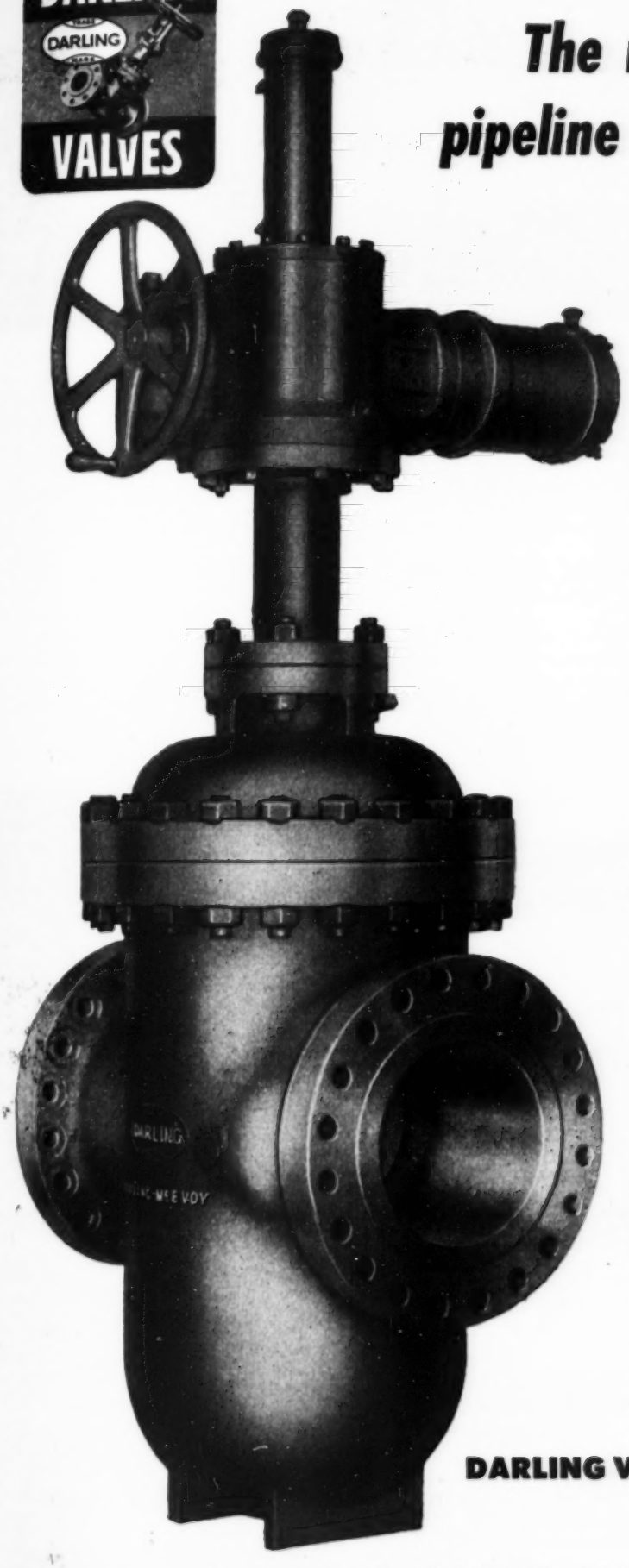

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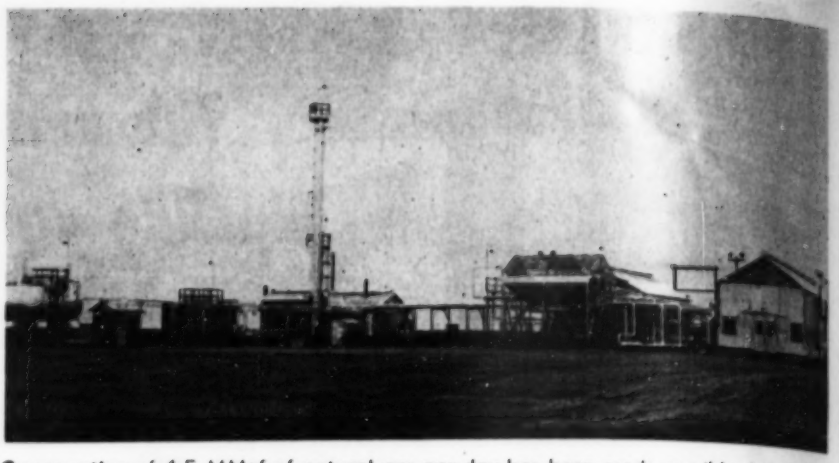
a development and exploratory nature. Another $4.2 million has been approved to cover the estimated cost of extension of Colorado Insterstate's gas gathering facilities in four natural gas fields.

The remainder of the budget is devoted to general additions to the company's system and properties with new and additional facilities provided in the Denver, Pueblo and Arkansas Valley regions.

First supply contracts signed by TransCanada

The first natural gas supply contracts have been signed by Trans-Canada Pipe Lines Ltd. and three major Alberta gas producers. Contracts calling for the purchase of more than 125 MMcf daily have been signed by Trans-Canada with Hudson's Bay Oil and Gas Co. Ltd., Canadian Delhi Oils Ltd., and Canadian Export Gas Ltd. and Associates.

N. E. Tanner, president of Trans-Canada, said that the gas now contracted for represents one-quarter of the capacity of the 2300-mile pipeline, and is sufficient to meet the needs of the pipeline for the first year of operation.



Conservation of 4.5 MMcf of natural gas per day has been made possible through construction of this gas compression and gasoline extraction plant at Sterling, Colo. Prior to its erection, under the direction of the Chemical Plants division of the Blaw-Knox Co., Pittsburgh, gas from the Mt. Hope basin was burned as waste. The plant was built as a joint venture by several major oil firms operating in the Mt. Hope basin to cooperate with authorities seeking to conserve natural resources. Construction required three months with an average field force of 35 local men, supervised by Blaw-Knox.

Transco's $4 million rate increase made effective

In recent rate actions, the FPC has made a suspended $4 million increase proposed by Transcontinental Gas Pipe Line Corp. effective, subject to refund.

In a separate order, the commission made effective increases totaling $2,465,000 by independent producers. This entire increase affects Transco.

In other actions, the FPC suspended a $1,526,600 increase of Michigan-Wisconsin Pipe Line Co.; allowed Natural

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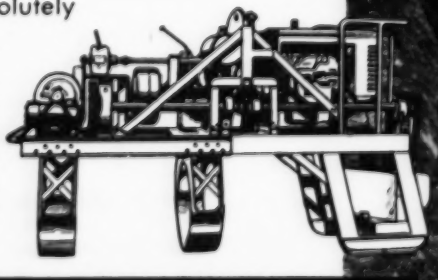

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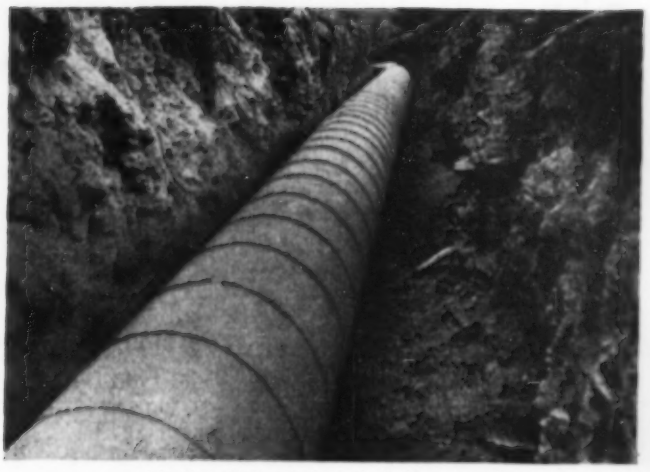
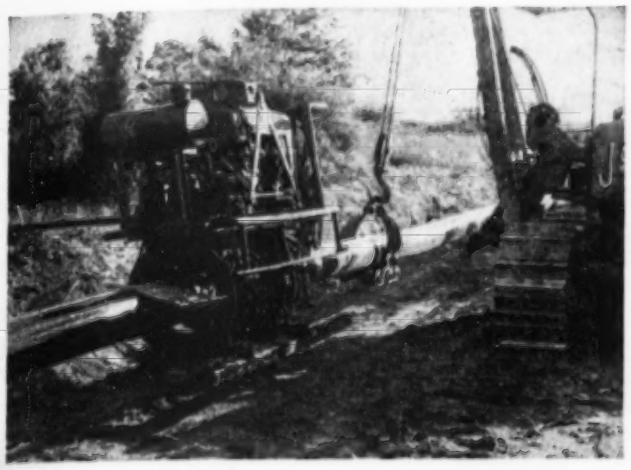
Pipeline laid over rugged terrain.



Pipeline ditch cuts through shale and rock.



Cleaning Machine and primer application.

NO-OX-ID and wrapper applied by Traveliner.

Why Corning Natural Gas relies on NO-OX-ID for pipeline protection

In 1954 Corning Natural Gas Company, Corning, N. Y., began expansion of their transmission system with 16 miles of 12-inch and 7 miles of 10-inch pipe. Dearborn NO-OX-ID Coating Combinations were specified. Over-the-ditch pipe protection was hot applied by a traveling, coating and wrapping machine using NO-OX-ID 2-C Primer, NO-OX-ID 6-X Coating and NO-OX-ID Reinforced Asbestos Wrapper.

WHY NO-OX-ID IS PREFERRED:

When asked how his crew liked working with NO-OX-IDs, the contractor, Mr. Joyce, stated: "They had never previously applied hot NO-OX-ID. The ease and convenience of application, plus freedom from personal hazards, caused complete satisfaction all around." As a result, Corning Gas plans to specify NO-OX-ID protection on additional pipeline reconditioning during 1955.

Before you specify on your next job, check with Dearborn...a Pipeline Engineer is available for consultation.

it pays to specify

Dearborn NO-OX-ID®

DEARBORN CHEMICAL COMPANY • Merchandise Mart Plaza • Chicago 54, Ill.

ADVANTAGES OF NO-OX-ID PROTECTIVE COATING

- ★ Applied hot or cold
- ★ By hand, by Traveliner or at the mill
- ★ No noxious fumes
- ★ Requires less equipment
- ★ Lasts longer

WRITE FOR BULLETIN

"Protecting Underground Pipe from Corrosion with NO-OX-ID and NO-OX-IDized Wrappers" tells the story. Your copy is ready upon request.

Gas Pipe Line Co. of America to reduce its suspended $10,702,000 increase by $642,000; suspended a $2,176,000 increase proposed by Transco; and accepted for filing a $1,047,000 increase proposed by Olin Gas Transmission Corp.

Panhandle's appeal to stop American Louisiana rejected

A petition by Panhandle Eastern Pipe Line Co. seeking to block American-Louisiana Pipeline Co.'s plan to build a $130 million line from Louisiana to Michigan has been dismissed by the Third Circuit Court of Appeals in Philadelphia.

In a unanimous decision, the court upheld the FPC's order conditionally authorizing American Louisiana and Texas Gas Transmission to build facilities to supply gas to Michigan Consolidated Gas Co. and Michigan Wisconsin Pipeline Co. Texas Gas would build facilities at Slaughters, Ky. to supply gas to American Louisiana.

The court's ruling declared that Panhandle had failed to show that it would be aggrieved by construction of the lines. "A crying demand for additional quantities of gas" exists in the areas to be served, it declared.

Supreme Court grants review in United rate case

The Supreme Court has granted to United Gas Pipe Line Co. and the FPC a review in companion cases of a decision by the Circuit Court of Appeals, which had held that a change in rates filed with the FPC by a natural gas company pursuant to Section 4(d) of the Natural Gas Act and permitted to become effective is not necessarily superior to nor does it supersede rates fixed by a prior private contract previously filed with the FPC as a rate schedule.

The FPC, according to the lower court ruling, should have rejected the filing of the changed rates until it had first determined the reasonableness or unreasonableness of the private contract rate.

Oranizational changes announced by the FPC

Realignments in its recently established bureau of rates and gas certificates and the office of the chief accountant have been announced by the FPC.

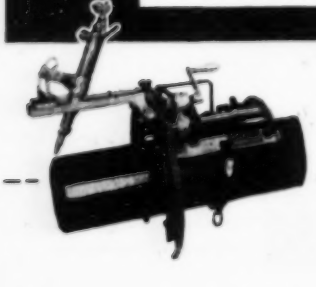
The realignments include the consolidation of the present two divisions—rates and gas certificates—in the bureau of rates and gas certificates, and the transfer from the office of the chief accountant to the bureau of rates and gas certificates of those accountants who regularly work on rate cases.

The commission said that the realignments will permit rate cases to be fully developed within one unit, with complete coordination of the accounting and engineering operations. The new organization also will permit the shifting of work assignments, depending on the gravity of the workload as its exists from time to time, without any necessary arrangements and coordination with other divisions. This will result in complete flexibility, with assignments being shifted to the most pressing work. The new organization also will eliminate duplications of records within the bureau.

▲ Every business has a "fatigue factor" in production efficiency. A man gets tired . . . his work slows down . . . he makes more mistakes . . . and the company loses money! Often without their knowledge, the handling of heavy equipment tires your pipeline welding crew.
Now, for the first time, there is a semi-automatic pipe cutting and beveling machine available which is **so light** it can be **manhandled** without serious operator fatigue.

The "ACHIN' BACK" that's costing you dough!

40% Lighter . . . Through an exclusive metal manufacturing process, the H & M Pipe Beveling Machine Company has reduced the weight of their equipment by 40%. The #5 machine, used on 28" to 36" diameter pipe, formerly weighing 155 lbs. now weighs only 95 lbs. and can be easily handled by two men. Weight reductions on other machines are proportionate. For detailed information, write today to: H & M, 311 East 3rd St., Tulsa, Oklahoma.



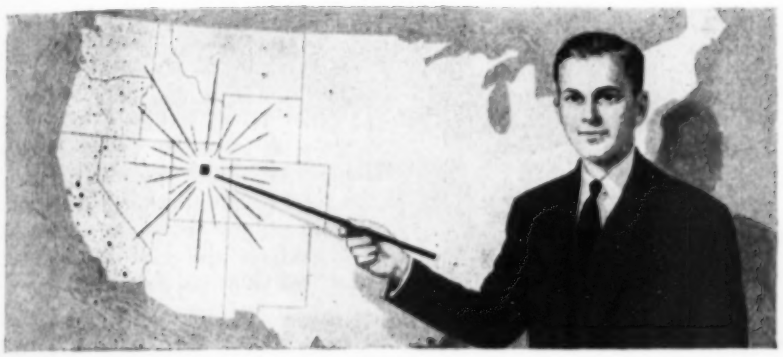
H&M PIPE BEVELING MACHINE COMPANY
U. S. Trademark Reg.

311 E. THIRD • TULSA, OKLA. • PHONE 3-0241

GAS pipeline notes

A bill that would authorize the North Dakota PSC to fix natural gas rates at the wellhead is now before the North Dakota Senate. The "Little Phillips" bill, as it has been dubbed by its op-

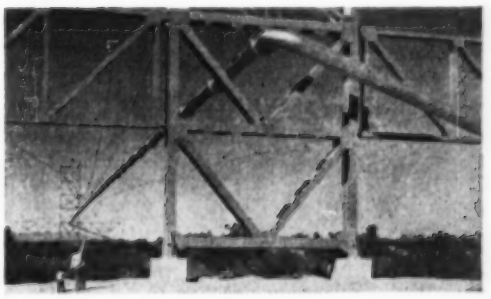
NEW UTAH PLANT to speed low cost delivery of USS quality gas and oil PIPE



Consolidated Western Steel Builds New Pipe Plant at Provo, "The Hub of the West"... to Better Serve a Growing, Building West

Strategically centered to reach you with the greatest possible efficiency, Consolidated Western's new plant will produce and deliver the highest quality electric-welded steel pipe at the lowest possible cost. Sizes available include 4" to 40" diameters to meet the needs of transmission pipelines as well as distribution systems and industrial installations. New long length Consolidated Western pipe is engineered and manufactured to provide (1) uniform circumference and roundness insuring perfect fit-up in the field; (2) uniform diameter and wall thickness coupled with high yield strength and ductility for maximum strength per ton of steel.

Because United States Steel emphasizes quality control from mine to mill to finished steel . . . its consistently high-quality steel pipe is in demand the world over. A major portion of the world's large-diameter welded-steel gas and oil pipe has been produced by the Consolidated Western process. For 100 years, the Consolidated Western Steel Division of United States Steel has pioneered the fabrication, erection and manufacture of pipe, structural steel, plate products and mechanical equipment—constantly proving that only steel can do so many jobs so well.



PIPELINE OVER THE COLORADO. Bridging the Colorado River between Arizona and California, this 1040 foot pipeline is built from high-strength sections of 30" welded-steel pipe manufactured by Consolidated Western. This important link—connecting the El Paso Natural Gas line to the Southern California Gas and Southern Counties Gas systems—is the second largest of its type in the world.

CONSOLIDATED WESTERN STEEL

Sales Offices: Los Angeles, San Francisco, Fresno, Bakersfield, California; Phoenix, Arizona; Seattle, Washington; Houston, Texas.

DIVISION

UNITED STATES STEEL

ponents, has been called "the biggest single piece of legislation so far . . . to kill off oil and gas development."

An exploration-development deal involving the potential evaluation of nearly 500,000 acres in the San Juan Basin-Four Corners area has been announced by John A. McGuire, president of Three States Natural Gas Co. Under the agreement, Reynolds Mining Corp., Houston, a wholly owned subsidiary of Reynolds Metals Co., is to start work before Nov. 1 on 10 exploratory wells in undeveloped acreage blocks held by Three States.

Authority granted by the FPC in December 1953 to Mid-Georgia Natural Gas Co., Atlanta, to render gas service to Covington and Oxford, Ga., has been revoked because the company failed to comply with conditions attached to the authorization. The revocation will not deprive the communities of gas service since the FPC in another proceeding directed Transcontinental Gas Pipe Line Corp. to retain an unallocated 1464 Mcf of gas per day for use by Covington to serve the two towns.

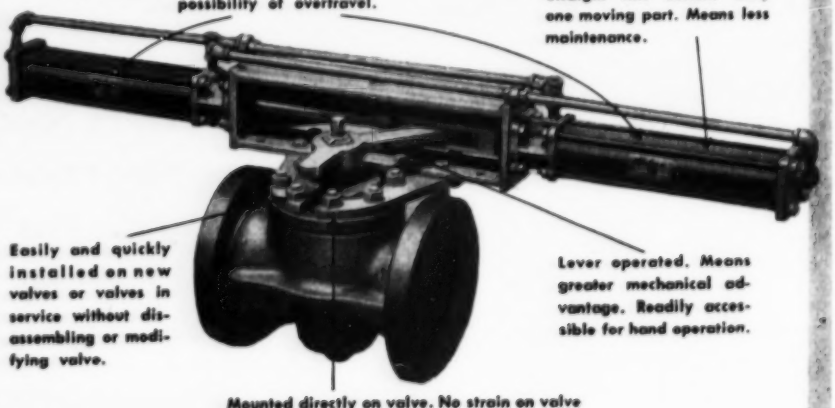
Mexico has reportedly signed a contract with a Texas company to pipe 500 MMcf of gas daily into the U. S. Officials of pipeline companies in Houston denied that such a contract had been signed, however.

Canadian Bechtel Ltd., Toronto, has opened offices in Vancouver and started surveys on the Peace river gas line for Westcoast Transmission Co. Ltd. Bechtel will be responsible for supervision of the engineering and construction between Fraser Valley points and the gas fields of northern British Columbia and Alberta.

Two wholly owned subsidiaries of Texas Gas Transmission Corp., Owensboro, Ky. have filed applications with the FPC seeking authority to merge with their parent company. The two companies, Louisiana Natural Gas Corp. and Texas Northern Gas Corp., both of Shreveport, are engaged primarily in the acquisition of gas reserves in the Louisiana Gulf Coast area for delivery to Texas Gas.

Humble Oil & Refining Co.'s application for a rehearing of the FPC's Dec. 17 order 174-B making further modification in its order 174-A has been denied. Humble's new application does not refer to any specific amendment or change of any section of 174-A, the FPC said, and the relief sought is identical with that requested previously.

Here is a Simple, Dependable, Safe Plug Valve Operator


Two cylinders working in tandem transmit smooth, constant torque to valve lever. No possibility of overtravel.
Cylinder-type operator. Straight line action. Only one moving part. Means less maintenance.
Easily and quickly installed on new valves or valves in service without disassembling or modifying valve.
Lever operated. Means greater mechanical advantage. Readily accessible for hand operation.
Mounted directly on valve. No strain on valve or stem. No special manifolds necessary.

Ledeen
VALVE ACTUATORS

Ledeen Valve Actuators have no rotating motors, gears, bearings, clutches or other fast-moving parts. They are straight-line, cylinder-type operators — simple, highly efficient and easy to control. Operated by high or low pressure, air, gas, oil or water. Suitable for automatic safety shut-off installations, blow-downs, instrument control and numerous other proved applications.

Write for Bulletin 3020

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VALVE ACTUATORS
AIR-HYDRAULIC
PUMPS & BOOSTERS

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1608 So. San Pedro St.
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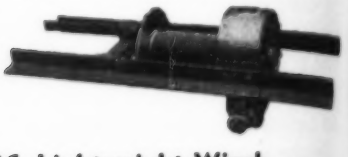
GAS new pipeline products

(For additional information, use coupon on page 80.)



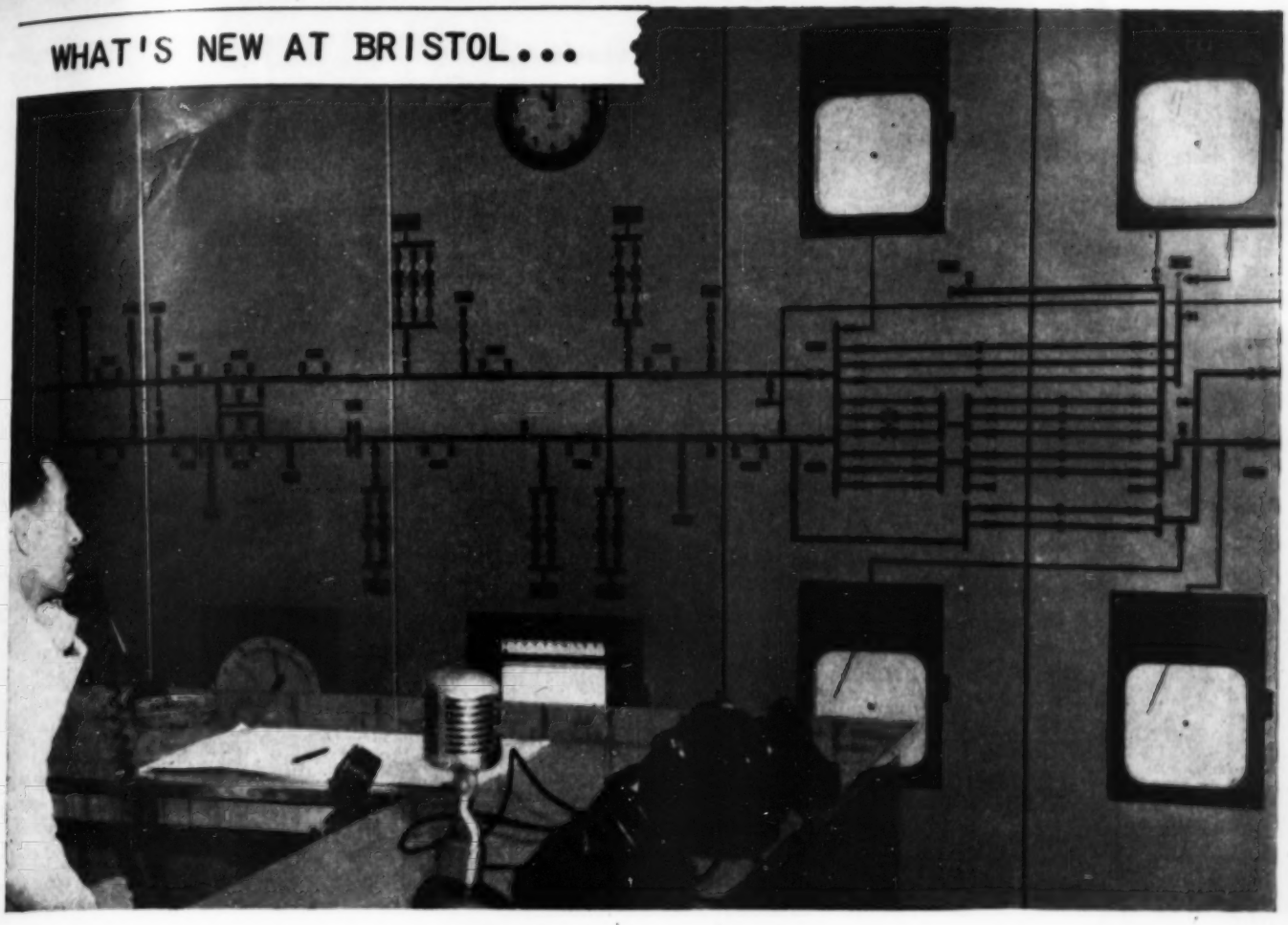
26 Lightweight Winch

A new lightweight winch has been added to the line manufactured by Tulsa Winch. Model 5 is 11 in. high and weighs only 80 lb; it is powerful enough to operate with a safe working load of 6000 lb.

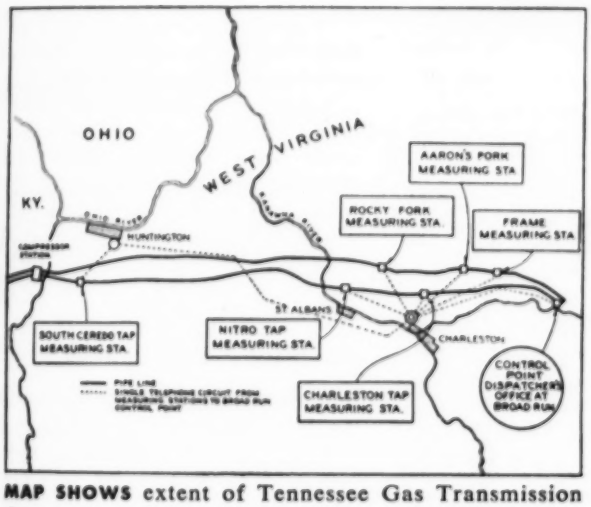
The new winch has a high worm gear ratio (60 to 1) that permits direct drive from the source of power and eliminates the need for a worm brake. Drive power may be provided by a small hydraulic or electric motor or power take-off. Model 5 can be driven from the right or left side of the transmission without disassembly.

Tulsa Winch

WHAT'S NEW AT BRISTOL...



Now you can dial for pressure readings



MAP SHOWS extent of Tennessee Gas Transmission Company's remote operations — all controlled through a Bristol Metameter Telemetering and Remote Control system over a single 74-mile circuit.

You're looking at the field dispatcher's office in the Broad Run, W. Va., station of the Tennessee Gas Transmission Company.

From this point, TGT controls the pressure, flow, and metering at six delivery points spread along a distance of 74 miles in the mountains of West Virginia. This control is accomplished with the help of a group of Bristol Metameter® Telemeters, *which supervise a total of 51 functions, over a single 74 mile telephone circuit.*

Wide demand variations make it necessary for Tennessee Gas to transfer as much as 3500 MCF of gas per hour from one point to another, on the request of the customer's dispatcher, at any hour of the day or night.

To accomplish this, the field dispatcher dials in any desired location, and reads the value of the measured function on his Metameter Telemeter receiver. By dialing the proper function, he can also remotely vary the flow controller on each meter tube, from no-flow to maximum flow.

Bristol has become the acknowledged leader in the telemetering field, in the opinion of thousands of leading companies throughout the country. Our bulletin M1710 tells why. Write for it today. The Bristol Company, 144 Bristol Road, Waterbury 20, Conn. 5.1

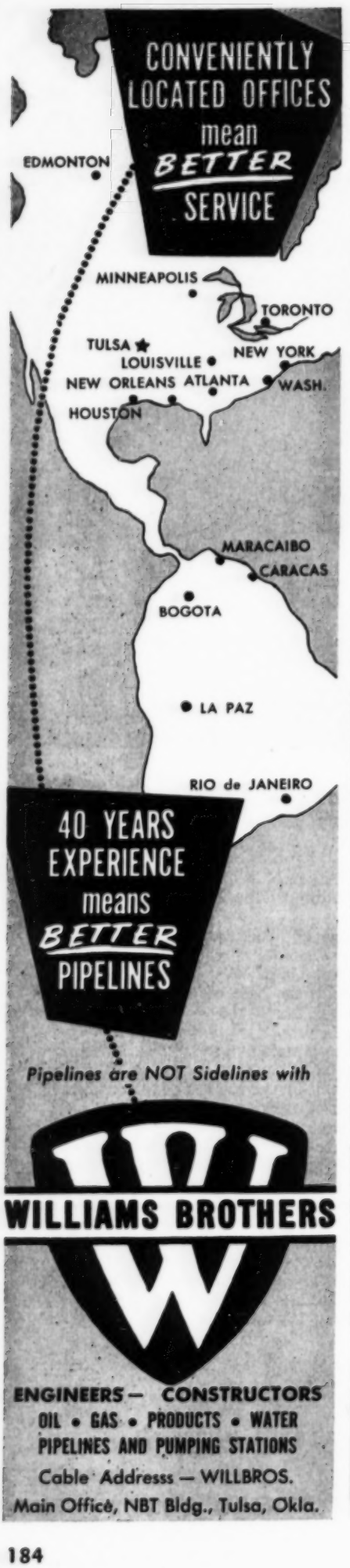
*Reg. U.S. Pat. Office

TRADE MARKS BRISTOL'S REG. U.S. PAT. OFFICE

BRISTOL

POINTS THE WAY IN HUMAN-ENGINEERED INSTRUMENTATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS



new products • *Cont'd.*

27 Oxygen Analyzer

A continuous specific oxygen analyzer, designed for low range measurement of oxygen in gaseous streams, has been introduced by the Davis Instruments Div.

Features of this analyzer are its simplicity of operation, its specific measurement of oxygen without interference by most other gaseous components, and its reproducibility over extended periods of time.

All components which come into contact with the gaseous sample or liquid stream are fabricated from stainless steel or plastic. Available equipment includes a self-supported panel, a single-point continuous indicator and recorder, circular chart recorder, flow chain cabinet with plexiglas window, and an explosionproof circuit breaker and pump.

Davis Instruments Div.

■

28 Trencher

Auburn Machine Works has introduced a gear-driven trencher with gears running in oil.

Jeep-A-Trench Gear-Draulic, as the new trencher is designated, has the unit well forward in the Jeep body over the frame, placing more weight on the front wheels.

Engine power is transmitted through a new gear drive connected to the Jeep's center power takeoff, supplying power to the digging ladder. A hydraulic drive provides the Gear-Draulic model with a forward speed variable from zero to fully engaged. The hydraulic drive oil cushions the shocks of changing soil conditions.

Auburn Machine Works Inc.

■

29 Annunciator

A compact audio-visual annunciator, which utilizes only one plug-in relay unit for each three-light high-low station, has been announced by the Panalarm division of Panellit Inc.

The new system saves panel space and reduces wiring requirements where a high-low annunciator is required. Each alarm station consists of a tier of three back-lighted windows. The top window designates "high" off-normal, the middle window designates "normal," and the lower "low" off-normal operations.

Panalarm Div.

■

30 Clay Digger

A heavy-duty clay digger from Davey Compressor is reputed to be highly efficient for excavating stiff clay and hard pan as well as concrete and shale. The latch-type chuck retainer on Model DD-30 permits a quick change of working steels.

Other features include a new type wafer plate valve with differential porting; a chrome-plated cylinder bore; built-in lubricator, which gives pressure lubrication to all moving parts.

Davey Compressor Co.

GAS trade literature

31 Engine Bulletin

LeRoi division of Westinghouse Air Brake Co. has issued a new bulletin describing and illustrating the 225- to 675-hp LeRoi L3460 and LA000 engines. The eight-page bulletin uses cutaway views and studio photos to show the advanced design features, applications, and basic specifications for the engines.

Le Roi Div.

■

32 Honeywell Catalogs

Two catalogs are available from Minneapolis-Honeywell Regulator Co. (When ordering copies, use letter preceding description along with number of this notice.)

(a) Instrumentation data sheet (10.5-1a) describes Surface Combustion Corp.'s dewpoint recorder, including details about the new multiple source type which automatically records dewpoints from six different sources in rapid succession.

(b) Bulletin 7201 describes the Honeywell quick-connect Tel-O-Set miniature recorder and controller.

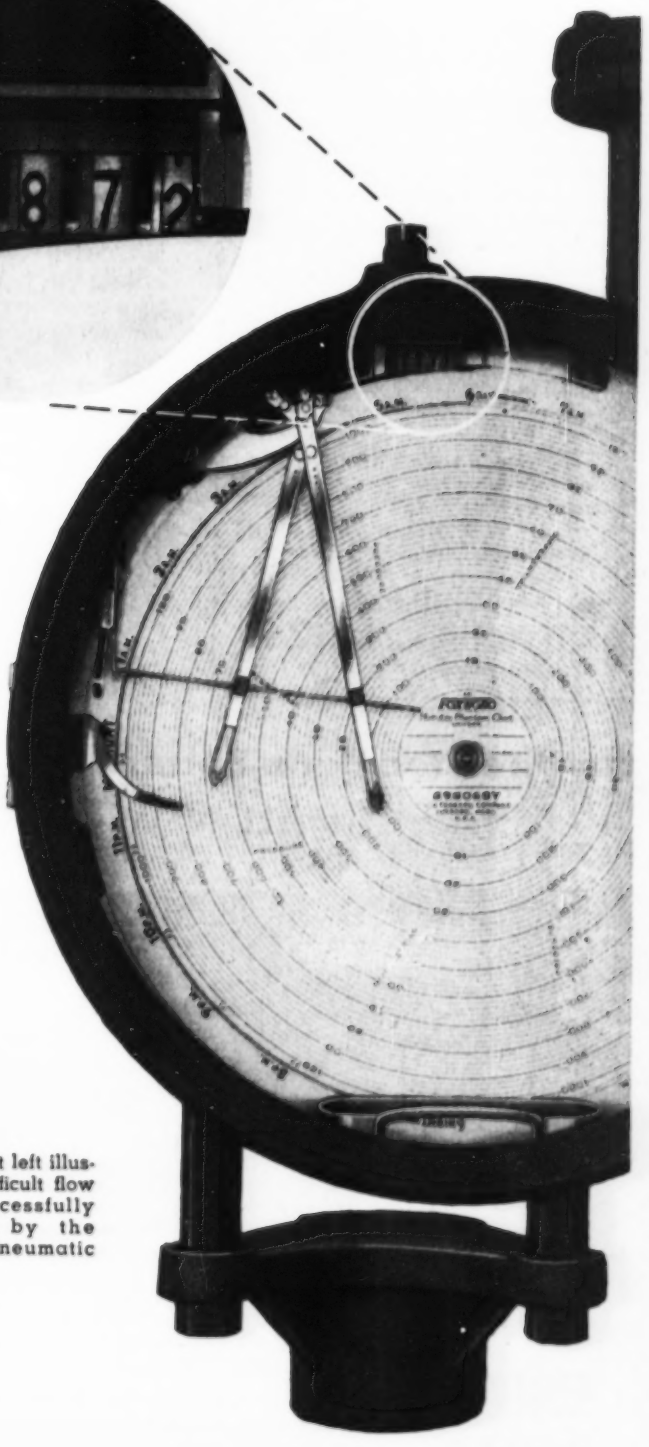
Minneapolis-Honeywell Regulator Co.

Read gas flow totals directly!

. . . with the Foxboro G. P. I.*

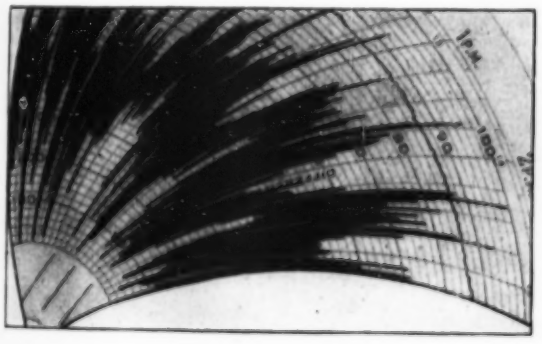
*Gas Powered Integrator

- ***Automatically totalizes rapidly varying flows***
- ***Eliminates planimetering***
- ***Requires no electricity***



Widely-swinging flows — like intermittent gas injection and gas feed to drilling rig engines — are no problem to the Foxboro Gas-Powered Integrator! The clear-cut counter of this rugged instrument gives totals directly in flow units . . . does away with inexact, time-consuming chart calculations.

The Foxboro G.P.I. is a field-tested performer widely used by leading companies. It has proved its accuracy and dependability . . . and its low maintenance . . . time and again. Look at your flow charts. If they resemble the chart illustrated here, you need G.P.I. . . . to save time and money. Available on all types of Foxboro Flow Meters. For complete details, write for Bulletin 7-11.



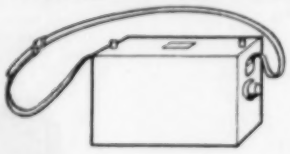
The chart at left illustrates a difficult flow pattern successfully totalized by the Foxboro Pneumatic Integrator.

THE FOXBORO COMPANY, 344 NORFOLK ST., FOXBORO, MASS., U.S.A.

FOXBORO REG U S PAT OFF — AUTOMATIC GAS FLOW TOTALIZING

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND

PICO ELECTRONIC HOLIDAY DETECTORS



Tests pipe coating or any insulating coating on pipe lines, tank bottoms, gas distribution systems, yard coating operations, water works, inside pipe lining, inside well tubing, chemical plants, refineries, or any application fro holiday inspection for voids or faults in the coating. Electrodes can be supplied for all types of work. The PICO Electronic Holiday Detector uses a 6 volt dry battery with an output of 18,000 volts D.C. It is mounted in a Plexiglas housing and weighs 13 lbs. Comes complete with pusher-handle and 7 Foot Electrode Spring. Price $290.00. Line-traveling type slightly higher. Write for literature.

PETROLEUM INSTRUMENT COMPANY
2200 W. ALABAMA • HOUSTON, TEXAS

GAS pipeline people

Six sales appointments have been announced by the Buflovak Equipment division of Blaw-Knox Co., Pittsburgh: HAROLD V. WILLIAMS is now assistant sales manager; ROBERT H. HAZLETT is gas equipment sales manager; EDGAR L. DEMAREST is district sales manager at Philadelphia; WARREN V. EISENHUTH will assist Mr. Demarest; HAROLD R. KIBBY is sales representative at Birmingham, Ala.; and GEORGE B. PHILIPS is sales representative in Chicago.

RICHARD L. ERLIN has been named manager of engineering sales for Kaiser Steel Corp., Oakland, Calif.

CHARLES M. STONE has become assistant chief engineer for Colorado Interstate Gas Co., Colorado Springs.

Transcontinental Gas Pipe Line Corp. has elected JOHN F. BURTON to the post of financial vice president and WILLIAM M. RICE treasurer.

Cooper-Bessemer Corp., Mt. Vernon, Ohio, has promoted ROBERT F. LAY to general sales manager and GRANT C. WOODARD to assistant general sales manager.

G. G. Dormer
Pittsburgh Group

R. F. Lay
Cooper-Bessemer

GEORGE G. DORMER has been named superintendent of compressor stations for the Pittsburgh Group of the Columbia Gas System.

New officers and directors have been elected for the L-O-F Glass Fibers Co., recently formed by the merger of Glass Fibers Inc. into the former Libbey-Owens-Ford subsidiary. GEORGE P. MACNICHOL JR. is board chairman; RANDOLPH H. BARNARD is president and general manager; JOHN D. BIGGERS, F. E. CAZAYOUX, D. DEAN MCCORMICK, and GORDON W. REED are directors; THOMAS A. COLLINS is vice president and director of sales.

JAMES W. O'KEEFE, formerly supervisor of special studies for Texas Gas Transmission Corp., Owensboro, Ky., has been named comptroller for Texas Gas Exploration Corp.

JOHN M. MAITLAND has been named of the Detroit district office of the Bristol Co., Waterbury, Conn.

GARLAND B. CHILDERS, staff engineer for Johns-Manville in the San Francisco district, has been appointed to the newly established position of general construction superintendent of the company's Industrial Products division with headquarters in New York.

RALPH WILL has been elected president of the Alberta Gas Trunk Line Co. Ltd. R. J. DINNING was elected chairman of the board and VERN TAYLOR, vice president.

W. TRUETT HOLLIS, production superintendent for El Paso Natural Gas Co.'s San Juan division, has been promoted to manager of drilling operations.

Another Job Done Better With The ALL-NEW 'Jeep'®

MOBILE POWER

You can save the cost of an auxiliary engine and the time lost in loading or towing it by putting an all-new 4-Wheel-Drive Universal 'Jeep' on the job. With power take-off, the 'Jeep' can be used to operate air compressors for pneumatic tools as shown above, electric power generators and other belt-driven equipment. Investigate the 'Jeep' and the auxiliary equipment that can be mounted on the 'Jeep' and operated by the 'Jeep' engine.

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The 'Jeep' Family of 4-Wheel-Drive Vehicles... UNIVERSAL 'JEEP' • TRUCK • STATION WAGON • PANEL DELIVERY

THE WORLD'S MOST USEFUL VEHICLES

I. W. Dods
Transco

E. C. Inghram
New York State

R. S. Jefferies

D. L. Barger
New York State Natural

I. W. DODS, pipeline construction engineer, has been named pipeline construction superintendent by Transcontinental Gas Pipe Line Corp., Houston.

Several promotions have been announced by New York State Natural Gas Corp., Pittsburgh. EDWARD C. INGHRAM has been elected vice president and will continue his duties as general superintendent; DONALD L. BARGER is superintendent of production and transmission; and ROBERT S. JEFFERIES is chief engineer and will continue his duties as superintendent of the station department. Other promotions include: EDWARD EMERSON JR., head of the personnel department; JOHN C. FERGUSON JR., head of the land department; CHARLES E. ALTMAN, superintendent of the new Sabinsville district; ELWOOD C. PETSINGER, superintendent of the lease department, southern area; ROY C. PATTERSON, superintendent of the new northern division; and JAMES M. HAWK, superintendent of the lease department, southern area.

W. W. BODLE, manager of the process and research department of J. F. Pritchard & Co., Kansas City, Mo., has been named manager of the Chicago district office and PAUL W. LAUGHREY has succeeded him in his former position.

HARRINGTON A. ROSE, secretary of the general management section of the AGA, has resigned from that position to join the customer relations department of Transcontinental Gas Pipeline Corp.

V. V. MALCOM, formerly of the Philip Carey Manufacturing Co., has been appointed vice president and general manager of the Perrault Equipment Co.

ALDEN H. WEBBER has been appointed to the position of field sales engineer for the Seattle (Wash.) area by Bristol Co., Waterbury, Conn.

M. W. COOK has joined Chiksan Co., Brea, Calif., as field engineer, covering the drilling, production and marketing industry throughout southern California.

EDWARDS PIPELINE SPECIALTIES

CONCRETE RIVER WEIGHTS

PIPELINE HALF SOLES

WELDING SLEEVES

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BERYLCO NON-SPARKING
SAFETY TOOLS

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2445 So. Jackson, Phone 3-7184
Tulsa, Oklahoma

Another Job Done Better With The ALL-NEW 'Jeep'®

REACHING REMOTE WORK SITES

Beyond the road's end, where the going is rough and steep, you can depend on the sure-footed 4-wheel-drive pulling power of the Universal 'Jeep' to take you right to the job. With a 'Jeep' you can climb steep grades, maneuver your way in dense woods, traverse loose rock and sand—*and get there!* That is why the 'Jeep' has become essential equipment for engineers, surveyors, geologists, miners and lumbermen. Get a demonstration.

WILLYS MOTORS, INC.
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The 'Jeep' Family of 4-Wheel-Drive Vehicles . . . UNIVERSAL 'JEEP' • TRUCK • STATION WAGON • PANEL DELIVERY

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GAS progress reports

APPROVED

TRANSCONTINENTAL GAS PIPE LINE CORP., Houston. Docket G-4185 for 360 miles of 36- and 30-in. line paralleling sections of system in nine states. Would include two river crossings; one 3000-hp and one 7500-hp station and miscellaneous additions to present stations.

CURRENT CONSTRUCTION

ARKANSAS LOUISIANA GAS CO., Shreveport. Docket G-2307 for 134 miles of 6⅝- to 24-in. line in 11 sections, and 10,500-hp compressor station on its system in Arkansas, Louisiana, and Texas. Compressor station and 71 miles of line completed.

EL PASO (TEXAS) NATURAL GAS CO. Docket G-2371 for 13.3 miles of line, 1540 hp compression, purification and dehydration plant, and metering facilities in Lea county, N. M.

EL PASO (TEXAS) NATURAL GAS CO. Docket G-2106 and G-2462 for 74 miles of line and 6925 additional hp on its system in Texas, New Mexico, and Arizona.

LONE STAR GAS CO., Dallas. A 22-mile, 18-in. line from Farmers Branch, Texas to Collin county to supply Texas Power & Light Co. Scheduled for completion in June.

MANUFACTURERS LIGHT & HEAT CO., Pittsburgh. Docket G-2193 for 72 miles of 20- and 16-in. line, 38.7 miles of storage and well lines, 2 measuring stations and a 1760-hp compressor station at the Victory storage field in Marshall and Wetzel counties, W. Va.

MANUFACTURERS LIGHT & HEAT CO., Pittsburgh. Docket G-2289 for construction of 75½ miles of 10-, 12-, 24-, and 26-in. lines and 4400 in new and additional compressor facilities in Washington, Allegheny, Chester, Lancaster, and Adams counties, Pa., and Marshall county, W. Va.

MANUFACTURERS LIGHT & HEAT CO., Pittsburgh. Docket G-2479 for 61 miles of line and 1760 hp in compressor capacity on its system in Ohio, Pennsylvania, and West Virginia.

OHIO FUEL GAS CO., Columbus. Docket G-2522. 880-hp compressor station under construction. Completion scheduled for April 15.

PACIFIC GAS & ELECTRIC CO., San Francisco. An 18-mile, 12-in. line in Colusa and Glenn counties to bring gas into Sacramento valley from two new fields.

PANHANDLE EASTERN PIPE LINE CO., Kansas City, Mo. Docket G-2433 for 575 miles of new line (294.6 miles approved), mainline loops, storage, lateral and gathering lines in Kansas, Missouri, Illinois, Indiana, Ohio, and Michigan and 113,000 hp in additional compression. Also includes development of Waverly storage field in Morgan county, Ill. Will increase peak-day delivery capacity from 970 to 1425 MMcf daily. Approved portion virtually completed. Balance awaits FPC approval.

SHENANDOAH GAS CO., Lynchburg, Va. Docket G-1448 for 39 miles of line from a point near Middletown, Va. to points near Winchester, Va. and Martinsburg, W. Va. Somerville Construction Co. scheduled to complete line this month and Martinsburg, W. Va.

SOUTHEAST ALABAMA GAS DIST., Birmingham. A "U" shaped system of about 330 miles to serve 24 communities in southeastern Alabama from connections with Southern Natural. About 25% completed. Scheduled for completion in September.

TEXAS EASTERN TRANSMISSION CORP., Shreveport, and **NEW YORK STATE NATURAL GAS CORP.,** Pittsburgh. Docket G-2784 to construct field pipelines to connect up additional wells in Murrysville pool; acquire 2000-hp field gathering compressor station; and install 1980-hp station. New York State will operate facilities.